DOCUMENT RESUME

ED 159 125 SO 011 162

AUTHOR Georges, Daniel E.
TITLE The Geography of Crime and Violence: A Spatial and Ecological Perspective. Resource Papers for College Geography, No. 78-1.
INSTITUTION Association of American Geographers, Washington, D.C.
PUB DATE 78
NOTE 37p.
AVAILABLE FROM Association of American Geoghaphers, 1710 Sixteenth Street, N.W., Washington, D.C. 20009 ($2.50 paperbound, quantity discounts available)

EDRS PRICE MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS Concept Teaching; *Crime; *Curriculum Development; Data Analysis; Ecology; *Environmental Influences; Geographic Concepts; *Geography; Higher Education; Instructional Materials; Literature Reviews; Maps; Social Change; Socioeconomic Influences; Sociology; Statistical Analysis; Tables (Data); Teaching Methods; Urban Environment; *Violence

ABSTRACT

The paper examines crime from a spatial perspective and provides an introduction to social ecology theory. The document is part of 8 series of resource papers intended to supplement college level geography textbooks. The geography of crime is defined as the spatial manifestation of criminal acts. The social ecological approach interprets crime as a function of the social change that accompanies environmental change. The document is presented in six chapters. Chapters I and II introduce the crime problem and compare geographic and social ecological approaches to crime and violence. Chapter III applies ecological principles to spatial analysis of crime. Topics include human ecology, symbiosis, community and society, delinquency rates, ghettos, and statistical analysis. Chapter IV identifies crime data sources and outlines a format for geographic analysis of crime. Chapter V explains that the major objective of the geography of crime is to relate the spatial pattern of crime to social, environmental, historical, economic, and psychological variables. The final chapter provides an exercise in applying statistical methods to crime. An appendix and a bibliography conclude the document. (Author/DB)

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THE GEOGRAPHY OF CRIME AND VIOLENCE: A SPATIAL AND ECOLOGICAL PERSPECTIVE

Daniel E. Georges
State University of New York at Albany

Spec Ill 162

RESOURCE PAPERS FOR COLLEGE GEOGRAPHY
NO. 78-1

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1710 Sixteenth Street, N.W.
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Library of Congress Card Number 78-050967
ISBN 0-89291-128-X

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FOREWORD

In 1968, the Commission on College Geography of the Association of American Geographers published its first Resource Paper, *Theories of Urban Location*, by Brian J. L. Berry. In 1974, coinciding with the termination of NSF funding for the Commission, Resource Paper number 28 appeared, *The Underdevelopment and Modernization of the Third World*, by Anthony R. deSouza and Philip W. Porter. Of the many CCG activities, the Resource Papers Series became an effective means for permitting both teachers and students to keep abreast of developments in the field.

Because of the popularity and usefulness of the Resource Papers, the AAG applied for and received a two-year grant from NSF to continue to produce Resource Papers and to put the series on a self-supporting basis. The 1977 Series is the first group produced entirely with AAG funding.

In an effort to increase the utility of these papers, the Resource Papers Panel has attempted to be particularly sensitive to the currency of materials for undergraduate geography courses and to the writing style of these papers. The present Panel continues to affirm the original purposes of the Series, which are quoted below:

> The Resource Papers have been developed as expository documents for the use of both the student and the instructor. They are experimental in that they are designed to supplement existing texts and to fill a gap between significant research in American geography and readily accessible materials. The papers are concerned with important concepts or topics in modern geography and focus on one of three general themes: geographic theory; policy implications; or contemporary social relevance. They are designed to complement a variety of undergraduate college geography courses at the introductory and advanced level.

The Resource Papers are developed, printed, and distributed under the auspices of the Association of American Geographers. The ideas presented in these papers do not imply endorsement by the AAG.

Many individuals have assisted in producing these Resource Papers, and we wish to acknowledge those who assisted the Panel in reviewing the authors' prospectuses, in reading and commenting on the various drafts, and in making helpful suggestions. The Panel also acknowledges the perceptive suggestions and editorial assistance of Jane F. Castner of the AAG Central Office.

Salvatore J. Natoli
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SUGGESTIONS FOR CLASS USE

This Resource Paper could be used effectively as a course outline in a graduate or undergraduate course dealing with crime from a spatial perspective. It can also serve effectively as a supplement to Harries' *The Geography of Crime and Justice* or to Georges and Harries' (eds.) *Crime: A Spatial Perspective* or to other textbooks for undergraduate or graduate courses in urban problems or the geography of crime. This paper also provides an introduction to social ecology theory, and would be useful in a criminology, sociology, introductory human-social geography, or urban geography course. Chapter Six provides an introduction to regression and correlation analysis, a basic associational statistical procedure employed by the various social science disciplines. Many of these statistical procedures may not be familiar to you or to your students, but you can gain some working knowledge about how to interpret them by examining some basic, general references on statistical methods. The bibliography contains a number of selected studies in the realm of crime analysis with a spatial emphasis.

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I. THE CRIME PROBLEM: SERIOUSNESS AND EXTENT

How pervasive is the crime problem that currently afflicts the American populace? What is the Geography of Crime? What is the Geography of Violence? What is the difference between the terms crime and violence? Is the geography of crime and violence just a rehash of issues raised by earlier social ecologists? If not, how does this "new" geographic orientation and perspective raise key theoretical issues and research questions? Why should geographers study crime? How does spatial analysis open new or different perspectives? Do geographers offer a new or unique methodology to the study of crime which differs from those commonly used by the sciences and disciplines most closely associated with the study of crime and the criminal justice process, e.g., sociology, criminology, criminal justice, psychiatry, psychology, law, and political science? Is there a geography of justice which might best be studied as a social phenomenon distinct from a geography of crime or violence? These questions are central to this paper and central to the author's work as an urban social geographer. This paper will attempt to address these questions and offer a sound scheme for the study of a Geography of Crime.

Definition, Extent, and Pervasiveness

The Source Book of Criminal Justice Statistics-1976 (Hindelang *et al.*, 1977) strongly indicates that the American public is not only concerned about the present level of crime in the U.S. but also believes that crime has increased within the past year or two. Most criminologists and criminal justice practitioners in both public and private sectors share this common assumption about an increasing incidence and rate of crime[1] (Figures 1 and 2).[2]. Current trends in crime occurrence and criminal victimization data have revealed a negative percent change from 1975; although property crime was up by 0.1 percent, violent crime was down by 4.5 percent (Table 1). This should not be misconstrued to mean that all serious crimes (what the FBI calls its Index Crimes) showed a marked decrease in 1976. In fact, the most recent FBI *Uniform Crime Report* reveals that the Crime Index Offenses of aggravated assault, larceny-theft, and forcible rape experienced positive percent changes over 1975, whereas the Crime Index Offenses of motor vehicle theft, burglary, and robbery experienced negative percent changes over the same time period (see Table 1). Unfortunately, *Uniform Crime Report* trend data for 1977 have not been released in final form.[3]

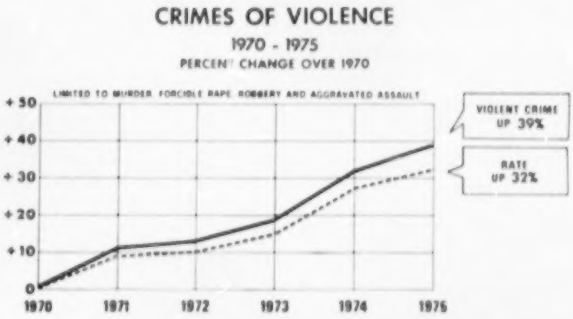

Figure 1. Source: U.S. Department of Justice, 1976: 13.

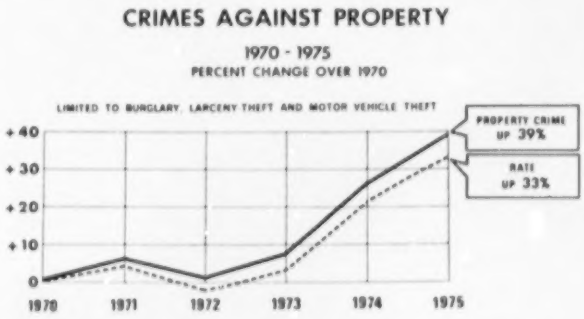

Figure 2. Source: U.S. Department of Justice, 1976: 14.

Researchers do not agree upon the definition of what should be included within a realistically comprehensive "crime universe" to be analyzed. This is in part the result of varying definitions of crime and of different reporting practices by the social control agencies delegated to prevent and report such incidents. Over time, "criminal acts" have changed in meaning from those which were not defined legally (and thus involve no official action against transgressing the rights of an individual or societal group) to illegal actions now defined by a law and punished by an official of the state. In brief, individuals who were wronged in the pre-law period would seek retribution against the wrongdoer's person or family. This system of personal retribution broke down only when the family structure changed

[1]Criminal incidence and rate of crime are not one and the same. Criminal incidence refers to a frequency count, e.g., there were thirty-one incidents of criminal homicide perpetrated in the fictitious city of Depur during the year 1947. Crime rate refers to the frequency of occurrence per some population figure, e.g., seventy-one incidents of criminal homicide per 100,000 population. This rate can be refined further by taking cognizance of the "population at risk" in the population figure (the denominator). For example, by most states' statutes, only women can be victims of a "forcible rape." Thus, when one calculates the crime rate for rape in a given state, and the population at risk is taken into account, the state's male population will be excluded from the statistical procedure involved in the calculation of the population at risk and thus in the calculation of the crime rate.

[2]The FBI's *Uniform Crime Report: Crime in the United States* recognizes three crime categories: crimes against persons, crimes against property, and crimes suggesting personal disorganization (although the FBI does collect other offense data, e.g., suspicion, traffic offenses, etc.).

[3]FBI Monthly Reports for 1977 are available, but the data have not been released in final form, i.e., in the annual reports called *Uniform Crime Report: Crime in the United States*. This report is scheduled for release in Fall 1978.

TABLE 1. NATIONAL CRIME, RATE, AND PERCENT CHANGE

Crime index offenses	Estimated crime 1976		Percent change over 1975		Percent change over 1972		Percent change over 1967	
	Number	Rate per 100,000 inhabitants	Number	Rate	Number	Rate	Number	Rate
Total	11,304,800	5,266.4	+.4	−.3	+37.0	+32.9	+91.5	+76.2
Violent	986,580	459.6	−3.9	−4.5	+18.2	+14.6	+97.3	+81.5
Property	10,318,200	4,806.8	+.9	+.1	+39.2	+35.0	+91.0	+75.7
Murder	18,780	8.8	−8.4	−8.3	+.6	−2.2	+53.4	+41.9
Forcible rape	56,730	26.4	+1.1	+.4	+21.1	+17.3	+105.4	+88.6
Robbery	420,210	195.8	−9.6	−10.3	+11.7	+8.4	+107.1	+90.5
Aggravated assault	490,850	228.7	+1.3	+.6	+24.9	+21.1	+90.9	+75.7
Burglary	3,089,800	1,439.4	−5.0	−5.7	+30.1	+26.2	+89.3	+74.1
Larceny-theft	6,270,800	2,921.3	+4.9	+4.2	+51.1	+46.5	+101.5	+85.4
Motor vehicle theft	957,600	446.1	−4.3	−5.0	+7.9	+4.7	+45.1	+33.5

Source: U.S. Department of Justice, 1976.

and private vengeance became difficult if not impossible. According to Reid (1976:4):

> Later the concept of crime developed but was confined to acts committed against the king (for example, treason), and private revenge remained the only punishment for acts against private citizens. Eventually the king, representing the state, realized that the peace of the community was at stake and decreed that when a person is wronged, that act should be reported to the king who would take action for punishment. Thus anyone who injured one of the king's subjects was considered to have injured the king, and the phrase "keeping the peace of the king" developed. Gradually the payment of compensation replaced family feuding and other forms of private revenge. If, for example, a neighbor stole your cow, you were permitted to take one of his cows. If, after the money system developed and he had no cow, you were entitled to the monetary value of the stolen cow. And because the king wanted some of the money too, the fine system developed; the fine going to the king (now to the state) and the repayment for the stolen cow to the owner of the cow.

Thus, a contemporary legal definition of crime might be similar to that stated by lawyer-sociologist Paul Tappan: "Crime is an intentional act or omission in violation of criminal law (statutory and case law), committed without defense or justification, and sanctioned by the state as a felony or misdemeanor" (1960:10).

It can be said that there is no crime without law and there is no law without punishment. This doesn't mean that an act legally defined as a crime will be defined in exactly the same manner throughout varying judicial units, or that all social control agencies will apply the same amount of skill, energy, manpower, or dedication to the enforcement of a given law throughout all localities. One should also be aware of the variable nature of actions that the state defines as violations of law. This variable nature is in part the result of changes in public attitudes toward specific "unusual" or unpopular behavior patterns such as victimless sex acts, drug usage, and other "crimes suggesting public disorganization," as well as of new developments in the technology of an era. For example, there can be no automobile thefts if there are no automobiles; prostitution or homosexuality would not be defined as crimes if the majority of a given population adhered to or condoned such practices; one might examine Nevada's penal code on prostitution.

The interpretation of the significance of increasing crime incidence or crime rates demands a critical appraisal of the crime data. For not only is crime unevenly distributed throughout a given macro-level spatial unit, such as a census tract or city, but the interpretation of the crime rate data presents us with numerous dilemmas (Harries: 1974; Sutherland and Cressey: 1974; Johnson: 1974). These dilemmas center around the extent and accuracy of victim reports to the police, the police reports to the FBI or some other state or federal bureaucracy, and the methods of manipulating and presenting data. Many of these issues will be discussed in Chapter Four. What should be noted at the outset is the differential possibility of being victimized or of being observed or apprehended for a specific act of criminality. Such differential visibility and apprehension coupled with inadequacy in the crime reporting and compilation process result in misleading, if not bizarre, crime rate data.

The Geography of Crime: An Approach

There is an approach, a methodology, and a theoretical foundation for the geographies of crime, violence, and justice which differ from other disciplinary approaches to the study of crime and criminal justice. Simply defined, the geography of crime is the study of the spatial manifestation of criminal acts. It is the study of the social and cultural organization of criminal behavior from a spatial perspective. It is not the study of the spatial organization and peculiarities of the judicial response to criminal behavior. Rather, the geography of justice would examine the geographical, or spatial, variations in the criminal justice process, i.e., the administration of law enforcement, sentencing, judges, juries, and correctional institutions. Such a geographic approach would go beyond the scope of a geography of crime.

It is also important to note that the geography of crime is not concerned with all acts of violence or impropriety. Some acts of violence are not crimes, and some acts of impropriety, though statistically rare or morally abhorrent, are not criminal, e.g., neither public drunkenness nor profanity is listed in the penal codes of all jurisdictions. A professional boxing match, although both popular and brutal, is not an act of criminal violence, nor would the corporal punishment of a child by a parent (if grievous harm did not result from such an action) be considered such an act.

Perhaps the best way to introduce the geography of crime is to place such a geography in perspective. This calls for at least rudimentary familiarity with the basic tenets and methodological approach of the "Chicago School of Sociology."

The Chicago School of Sociology: A Social Ecological Approach

Geographers and social ecologists have endeavored to study the spatial relationships of the urban environs for over fifty years, i.e., since University of Chicago sociologists Robert E. Park and Ernest W. Burgess coined the term "human ecology" in their textbook *An Introduction to the Science of Sociology* (1921). They later expanded this book in conjunction with Roderick McKenzie (1925). Park posited that "most if not all cultural changes in society will be correlated with changes in its territorial organization, and every change in the territorial and occupational distribution of the population will effect changes in the existing cultures" (Morris, 1958: 2). In brief, Park postulated an intimate congruity between the social order and physical space, between social and physical distance, and between social equality and residential proximity. From these ideas about the *relationship* between the social organization and physical spatial expression of a given phenomenon have sprung the disciplines we call social ecology and social urban geography.

More specifically, the Chicago School of Sociology, under the leadership of Ernest W. Burgess, with Clifford R. Shaw, Henry D. McKay, Robert E. Park, Frederick Thrasher, Clark Tibbitts, Roderick D. McKenzie, Nel Anderson, Louis Wirth, Harvey Zorbaugh, and others, developed America's first large-scale theoretical and research approach to the study of the nature of crime. In their social ecological approach they developed ecological theories dealing with the distribution and relationship of certain phenomena to their environment. Thus, they attempted to explain crime as a function of the social change that accompanies environmental change. Burgess' Concentric Zonal Hypothesis (Figure 3) was the first of these major ecological theories to become popular in Chicago in the 1920's and 1930's. This hypothesis will be explained in Chapter Three. Shaw, McKay, Burgess, and the other members of the Chicago School viewed the social disorganization or lack of community control found in

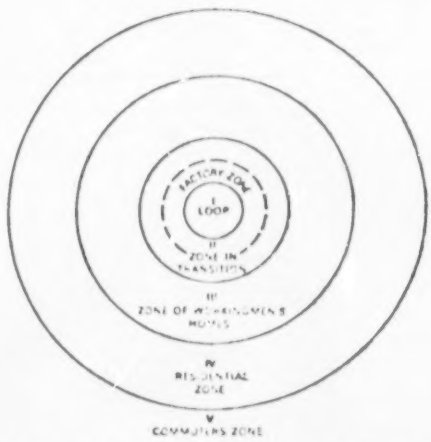

Figure 3. Model of Concentric Theory of Urban Structure. Source: Park *et al.*, eds., 1925: 51–53.

specific inner city districts as responsible for generating high official rates of law violation. They rejected the tenets of early criminological theory which had focused on characteristics of individuals as causal agents in crime, e.g., the theories of Beccaria, Lombroso, Bentham, and other representatives of the Classical, Neo-classical, and early Positive Schools of Criminology (see Knudten, 1970; Reid, 1976).

The Chicago School's ecological approach expounded the view that crime and vice would flourish in zones of transition, i.e., in zones of mixed land use or extensive socio-economic heterogeneity. These ecologists believed that people who live in transition zones are not only economically deprived (since these are areas of socio-economic deprivation, i.e., slums) but that they also lack many of the social and cultural opportunities of the middle and upper classes. The early ecologists would plot the residences of alleged juvenile criminals and then mark the city off in square miles (or some other spatial unit) and compute a delinquency rate for each area. Delinquency rates were in part calculated by compiling and examining arrest reports provided by the legitimate social control agencies, and in part by the social anthropological approach of systematic observation. The ecologists would observe the social dynamics of crime on a primary level by engaging in walking tours of specific neighborhoods or by residing in these neighborhoods for an extensive period of time. Nonetheless, it is important to realize that the ecologists did not argue that "the area causes the crime." In fact, Shaw and McKay (1931) specifically warned that high correlations between variables may not be taken as cause-and-effect relationships. Rather, the ecologists argue that the "cause" might be a third factor in each case. Thus, the social ecological approach was to stress relationships, i.e., association, not cause. It was to stress social process, cultural change, and urban expansion. The Chicago School's approach was essentially, although not totally, descriptive.

II. THE GEOGRAPHY OF CRIME: A GEOGRAPHIC OR SOCIAL ECOLOGICAL APPROACH?

In what ways are the geography of crime and social ecology similar? Do they share similar theories, methodologies, and metaphors? Has one field evolved from the other? How do micro- and macro-level geographic analyses differ?

Some geographers and criminologists would argue that social ecology and the geography of crime are one and the same, that they share a common academic heritage from the Chicago School of Sociology, and that this "new" geography evolved from that School's approach. Despite a common academic heritage, however, they are not the same discipline with different names. There is a substantive difference between the social urban geography we label the geography of crime and the social science disciplines of criminology and social ecology.

Urban social geographers who study crime are interested not only in the social organization of the criminal act, for that would make them criminologists; nor are they interested primarily in the relationship between the social organization and physical spatial expression of a given act of crime, for that would make them social ecologists.[4] Although social urban geography is interested in the relationship between the social organization of the criminal expression and the physical space in which it occurs, what makes it unique is its focus on the spatial expression of the violent or criminal act and the possible diffusion of similar acts or social organizational factors which enables the spatial manifestation of the act to occur in a given locale.

Thus, the geography of crime might attempt to identify and analyze the socio-cultural variables that result in the physical spatial expression of the abnormally high frequency of occurrence of certain criminal acts, or it might attempt a descriptive analysis of the act itself. The first approach would hope to result in the development of a theory of cause-and effect. The second approach is basically descriptive, i.e., associational. This second approach has been dominant in the realm of social ecology, and some might argue that it has also stigmatized the geography of crime. It is also important to remember that the research methodology of social ecology tended to stress the social anthropological approach—systematic observation, a tool used rather sparingly by most contemporary urban geographers of crime. Such an approach would entail the systematic observation of the incidence of criminal victimization in a given neighborhood. Thus, the researcher might attempt to reside within an area of frequent crime commission and routinely observe and record the observance of criminal behavior within that area. Or perhaps the researcher might attempt to walk or drive the same route at approximately the same time every day and record observations of criminal behavior perpetrated by the population along the route.

[4]Social ecologists are interested in the relationship manifest in the acronym POET. That is, *people* (the human factor); the social *organization* of the act; the *ecology* or *environs* (the spatial element); and the *time* at which the act took place. One might also note that social ecologists often invest their treatises with the phraseology of the social organism.

Geography and Centrography

Still another basic difference in the research methodologies and theoretical orientations of the geography of crime and social ecology has been the former's interest in centrographic[5] as well as cartographic or associational analysis (e.g., correlation, regression, and factor analysis[6]) with predictive (cause-and-effect) models in mind. Typical techniques that geographers use are illustrated in Tables 2 and 3 and in Figure 4, all of which have been extracted from Keith Harries' (1974)

TABLE 2. LIST OF STATES WITH CRIME RATES FALLING IN HIGHEST FIVE IN AT LEAST ONE INDEX CATEGORY

States	*Rank of State on Total Crime Index*	*Index Crime Category in Which State Fell in Highest Five*							
		Murder	*Rape*	*Robbery*	*Assault*	*Burglary*	*Larceny Over $50*	*Auto Theft*	*Row Totals*
California	1		X	X	X	X	X	X	6
New York	2			X		X	X	X	4
Maryland	3		X	X	X	X		X	5
Nevada	4						X		1
Florida	5	X			X	X			3
Arizona	6						X		1
Hawaii	7					X			1
Michigan	8		X	X					2
Rhode Island	9							X	1
Colorado	11		X						1
Massachusetts	12							X	1
New Mexico	14						X		1
Missouri	15		X						1
Texas	19	X							1
Illinois	20			X					1
Louisiana	25				X				1
Georgia	30	X							1
Alabama	33	X							1
South Carolina	35	X							1
North Carolina	38				X				1

Source: Harries, 1974: 25.

[5]Centrographic analysis or centrography refers broadly to using descriptive statistics for measuring the central tendency of various areal distributions or to translate formal statistical measures of centrality and dispersion into a two-dimensional spatial plane.

[6]See Chapter Six.

TABLE 3. INTERCORRELATIONS BY STATES BETWEEN REPORTED INDEX OFFENSES, 1968*

	Murder	*Rape*	*Robbery*	*Assault*	*Burglary*	*Larceny*	*Auto Theft*
Murder	1.00	.45	.28	.70	.12	.03	.01
Rape		1.00	.64	.65	.62	.63	.40
Robbery			1.00	.62	.69	.61	.62
Assault				1.00	.47	.37	.27
Burglary					1.00	.88	.75
Larceny						1.00	.65
Auto Theft							1.00

Pearson's "r"
Source: Harries, 1974: 21.

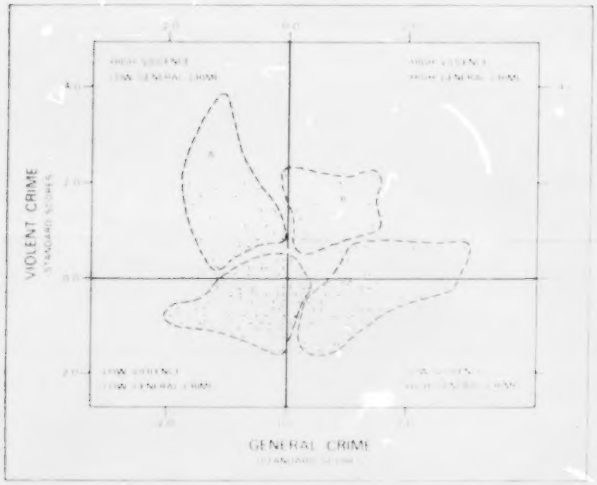

Figure 4. Delinquency Rate Gradings Represented in Distance from Chicago Loop Area. Source: Harries, 1974: 52.

excellent pioneering work on the geography of crime and justice.

Typifying the contemporary geographic approach, Stephenson (Georges and Harries, unpublished manuscript) argues that centrography offers a useful, complementary spatial methodology to the associational ones, and that it can provide objective quantitative statements of a descriptive nature about the morphology of static criminal distributions. Juvenile delinquency or crime data for a specific city, by applying centrographic techniques, may depict the utility of measures such as mean center, standard distance, standard deviational ellipse, and coefficient of circularity. In addition to providing information on static distributions, centrographic analysis may be extended to the spatial dynamic context in order to assess patterns of movements of criminals or delinquents between places of offense, i.e., the journey-to-crime.

The centrographic component of the geography of crime, construed in an origin-destination framework, might analyze delinquency and crime data using some of the measures of assessing regularities of movement in a manner similar to that proposed by Stephenson (noted above). The spatial morphology of movement patterns can also be noted by a centrographic approach that transforms movement vectors into a spatial distribution by rotation and translation of reference axes.

A simple application of a centrographic technique would be to ask if the area of crime commission (criminal victimization) and the area of criminal residence is the same for the juvenile delinquent as it is for the adult criminal who performs the same "crime specific" violation, i.e., an act of aggravated assault or a commercial burglary. The centrographic approach might also ask if the mean distance between the place of residence and the area of crime commission increases with the age of the suspect (or arrestee) or even if the average distance between these two crime or delinquency areas differs with the "crime specific" category, i.e., rape, criminal homicide, burglary, etc. Thus, a step-by-step analysis might be as follows:

(1) Identify the crime specific category of interest in the study, e.g., commercial burglary.
(2) Identify the "criminal agents," i.e., are we concerned with juvenile delinquents or adult criminals who are suspects or arrestees? Let us assume that we are interested in adult and juvenile arrestees.
(3) Calculate the distance between the area of criminal/delinquent residence and the area of crime commission for the various crime specific categories.
(4) Note the average (mean) distance from the area of residence and the area of crime commission for each crime specific subset cross-tabulated (i.e., cross-referenced) with the adult and juvenile arrestee subset (these can be further subdivided by age gradients if desired).
(5) Conclude that adult criminals do/do not travel further distances than their juvenile counterparts who commit the same crime specific violation, a calculation that Phillip Phillips (Georges and Harries, unpublished manuscript) refers to as "characteristics of the journey to offense."

Nonetheless, centrographic analysis cannot be identified as the key research methodology employed by geographers of crime, in the manner that associational measures are identified with social ecologists. It is also necessary to know that social ecologists were aware of the distinction between delinquency areas of crime commission and delinquency residence, and dealt quite adequately with this duality by means of the concept of population at risk, which will be discussed in detail in Chapter Three.

Associational/Descriptive Analysis

The most common criticism leveled against the social ecologists was that their approach was simply associational/descriptive analysis. They did, however, believe that the nature of the crime data universe and weaknesses in contemporary statistical procedures necessitated the development of associational theories rather than predictive cause-and-effect theories. This

is also a basic belief shared by many geographers of crime, including the author.

A final difference in the orientations of the geography of crime and social ecology was the lack of a psycho-spatial focus in the work of the Chicago School; that is, in their crime studies the early social ecologists did not concern themselves with the issue of cognitive mapping. They did not focus on the issue of significant difference between a "reality" victimization rate within a given area (as determined by data provided by social control forces) and a perceived victimization rate for a given area (as determined by misleading news media accounts of the type and rate of victimization within the same spatial unit).

To summarize, the geography of crime and social ecology appear to share a common heritage, i.e., the theoretical formulations of the Chicago School of Sociology. They also appear (in part) to employ the same methodology—the associational/descriptive approach. They differ in that the contemporary social geography of crime often (but not always) goes beyond associational/descriptive analysis. That is, geographers often attempt to develop analytical models which employ probability theory with the hope of creating predictive cause-and-effect propositions. Geographers also rely upon computers, psycho-spatial analysis (cognitive mapping), and centrographic techniques for analyzing crime data much more than did their social ecological counterparts. The contemporary social urban geography of crime also appears to avoid reliance upon the social organistic metaphors so pervasive in the social ecology typified by the Chicago School and its adherents. The analysis of adult crime appears to be central in geographic analysis in a manner similar to the centrality of studies of juvenile delinquency in social ecology. This is probably because of the strengthening of non-disclosure laws which protect juvenile offenders, rather than because of a shift in criminological research interests by geographers.

Micro-Level Analysis

In order to examine more closely the methodology of the geography of crime, it is pertinent to point out that geographic analysis of the criminal act might be on either the micro- or the macro-level. Micro-level analysis explores the exact physical location of the act focusing on the geographic concept of site and on the type of physical location in which the criminal act occurred. It also includes the social and environmental factors present at the locational target of the incident. A typical research strategy would be to ask if the incident occurred within a physical structure (single-family dwelling, bar, school, store, or church) or in a street location such as a park or parking lot. The researcher would then attempt to tie the site location to the socio-cultural dynamics of the criminal act. For example, the geographer might wish to examine the process of violent crime perpetrated against the elderly in Dallas, Texas (Georges and Kirksey, 1977–78). The first step would be to define the universe (particular population characteristics) of crime victims. We might arbitrarily select age fifty as the lower boundary of the age delimiter (or we might use some other age, e.g., sixty-five, since this is often the age of retirement). The universe of victims must also be delimited by defining the criminal act. Four crimes are traditionally classified as acts of criminal violence: forcible rape, criminal homicide, robbery, and assault. We might then include the following variables for each case of criminal violence: the site location at which the incident occurred (that is, the structure or non-structure in which it occurred); the hour of the day or night at which it occurred; the race or ethnicity of the victim; the race or ethnicity of the suspect (or arrestee); the sex of the victim; the sex of the suspect (or arrestee); the weapon or weapons used by the suspect (or arrestee); climatic factors during the time of the victimization (that is, light or heavy rain, extreme heat or cold, full moon). Cross-tabulations would then be run in order to provide information on frequencies of association of various variables. One might also aggregate the data and get percentage figures or averages in order to use a more sophisticated measure of association, e.g., correlation or regression analysis. In any case, micro-level analysis keys on the exact spatial location of the incident and the social dynamics of the victimization process, or the site's relationship with socio-cultural variables such as weapon use, the dynamics of a lower class bar-oriented culture, or sex-determined role-sets. Tables 4 and 5 are examples of micro-level analysis extracted from a study (Georges and Kirksey, 1977–78) associating the robbery and rape of elderly Dallasites by the locations where these incidents occurred.

Another example of the strategy employed in micro-level spatial analysis might be to note the spatial distribution of illegal bombings (or bomb threats) in a given city (Georges and Zandi, 1978–79). Such a study might examine the relationship among the following variables: motive behind the incident, method and technique involved in the incident, location of facility bombed or threatened, race or ethnicity of the suspect (or arrestee), race or ethnicity of the owner of the object of the attack or threat, time of the day or night at which the incident occurred, and whether or not damage or casualties resulted from the bombing. Again one would run cross-tabulations and develop frequency counts attempting to identify associational factors. One might, as noted earlier, aggregate the data and develop ratio or percentage figures to analyze the data by statistical procedures, e.g., regression or correlation analysis. (An example of regression analysis is presented in Chapter Six.)

The following table and figures are taken from two recent studies. Table 6 notes the most common object of bomb threats and bombings in the city of Dallas during 1975. Figures 5 and 6 note arsons in Newark, New Jersey during the 1967 riot, and incidences of major areas of fires and lootings during that same riot. Those interested in how multiple and partial correlation analysis may be applied to a geographic question such as areas of arson during and before a major riot might

TABLE 4. ROBBERY BY LOCATION* IN DALLAS

	Count	Per cent
Not Given	2	0.3
Parking	86	14.6
Apartment	33	5.6
Yard	44	7.5
Street	259	44.0
Single Family Dwelling	78	13.3
Misc.	9	1.5
Bar	2	0.3
Pool Hall	0	0.0
Laundry	2	0.3
Misc. Office	1	0.2
Parking Pay	4	0.7
Music	1	0.2
Gas	4	0.7
Hotel	1	0.2
Shoe Shine Parlor	0	0.0
Rooming	2	0.3
Lot Shop Center	19	3.2
Book	0	0.0
Cab Driver	1	0.2
Garage	1	0.2
Market Super	5	0.9
City Govt.	0	0.0
School	0	0.0
New Car	1	0.2
Market Small	2	0.3
Liquor	1	0.2
Car Wash	3	0.5
Hospital	0	0.0
Restaurant	2	0.3
Police Bldg.	1	0.2
Dept.	0	0.0
Vacant Lot	1	0.2
Travel	1	0.2
Bank	1	0.2
Constr. Site	1	0.2
Park	5	0.9
Motel	7	1.2
Church	2	0.3
Duplex	1	0.2
Auto Repair	1	0.2
Market Drive	1	0.2
Vacant Bldg.	1	0.2
Federal Govt.	0	0.0
Used Car	0	0.0
Warehouse	1	0.2
Bowling	0	0.0
Shoe	0	0.0
Not Given	1	0.2

*588 reported robbery incidents which comprise 64.3 percent of all violent crime for the time period October 1974–September 1975.
Source: Georges and Kirksey, 1977–78: 157–158.

TABLE 5. RAPE BY LOCATION* IN DALLAS

	Count	Per cent
Not Given	0	0.0
Parking	0	0.0
Apartment	8	24.2
Yard	2	6.1
Street	4	12.1
Single Family Dwelling	16	48.5
Misc.	0	0.0
Bar	0	0.0
Pool Hall	0	0.0
Laundry	0	0.0
Misc. Office	0	0.0
Parking Pay	0	0.0
Music	0	0.0
Gas	0	0.0
Hotel	0	0.0
Shine Parlor	0	0.0
Rooming	0	0.0
Lot Shop Ctr.	0	0.0
Book	0	0.0
Cab Driver	0	0.0
Garage	0	0.0
Market Super	0	0.0
City Govt.	0	0.0
School	0	0.0
New Car	0	0.0
Market Small	0	0.0
Liquor	0	0.0
Car Wash	0	0.0
Hospital	0	0.0
Restaurant	0	0.0
Police Bldg.	0	0.0
Dept.	0	0.0
Vacant Lot	1	3.0
Travel	0	0.0
Bank	0	0.0
Constr. Site	0	0.0
Park	0	0.0
Motel	0	0.0
Church	0	0.0
Duplex	1	3.0
Auto Repair	0	0.0
Market Drive	0	0.0
Vacant Bldg.	0	0.0
Federal Govt.	0	0.0
Used Car	0	0.0
Warehouse	0	0.0
Bowling	1	3.0
Shoe	0	0.0
Not Given	0	0.0

*33 reported rape incidents which comprise 3.6 percent of all violent crime for the time period October 1974–October 1975.
Source: Georges and Kirksey, 1977–78: 157–58.

TABLE 6. OBJECT OF ATTACK IN DALLAS

Object of Attack	Ranked by Frequency of Incidents	Number of Incidents	Percent of Total
Bar	1	34	8.6
Miscellaneous	2 (actually tied for first)	34	8.6
Single Family Dwelling	3	31	7.8
Supermarket	4	26	6.6
Miscellaneous Office	5	25	6.3
Hospital	6	24	6.1
Restaurant	7	20	5.1
Department Store	8	17	4.3
Federal Government	9	15	3.8
School	10	13	3.0

Source: Georges and Zandi, 1978–79.

review Georges' 1975 study of arson during and before the July 1967 Newark riot. A later study (Georges and Zandi, 1978–79) noted that bars and lounges (central elements in the lower class culture of white persons) made up a disproportionate share of the "locational targets" of white arsonists, bombers, and bomb threateners in Dallas in 1975. Such a finding raised the following questions: Are the locational targets of white arsonists, bombers, and bomb threateners different from those of their Native American, Hispanic, and black counterparts? If so, is there something unique about the Texas white "macho" culture that might result in a disproportionate number of violent incidents in certain

Figure 5. Arsons in Newark During the 1967 Riot. Source: Georges, 1975: 218.

types of facilities, e.g., murders, assaults, bombings, incendiaries, and bomb threats in or against bars and lounges (rather than in grocery stores and restaurants)? Are bombings of black-owned facilities usually perpetrated by blacks, i.e., is the phenomenon of illegal bombings and bomb threats dominated by one race rather than by another, and are these incidents usually intraracial (as are incidents of criminal violence)? Is there a spatial ecology and thus a differential distribution of bombings and bomb threats within a given city and does this spatial distribution differ for each ethnic or racial group?

In brief, micro-level spatial analysis is an effective tool for noting the tendency of specific locational targets to be tied to specific socio-cultural complexes. Identifying such tendencies might suggest relevant macro-level spatial analysis. For example, the findings of the bomb study cited above suggested the relevance of a research approach which considered the social ecological distribution of the targets of interracial and intraracial bombings and bomb threats within the varied ethnic and racial zones of Dallas.

Macro-Level Analysis

Macro-geography is the second level of geographic analysis. On this level, we attempt to aggregate the data and we increase the scale of the analysis, that is, the analysis is on a large scale and thus in less detail. For example, we aggregate criminal homicides or robberies by police or federal census tracts, police beats, and report areas. Such an approach might suggest the possible relationship that exists among varied spatial ecological expressions such as slums; the ghetto core, fringe, and transition zones; mass transit; suburbanization; the highway system; and the occurrence of specific acts of criminal and non-criminal violence. The previously mentioned study (Georges and Zandi, 1978–79) used micro-geographic analysis of bombings, bomb threats, and incendiaries to reveal that the locational targets of these incidents might differ for the varied ethnic or racial groups noted in that study and that these varied groups might have different motivational and weapon expressions. For example, blacks might be motivated by financial reward for profit (extortion), whereas whites might be motivated by revenge. Blacks might use the fire bomb or Molotov Cocktail as their primary weapon of "psychic terror," whereas whites more frequently use high explosives such as plastiques to insure more frequent kills and property damage. Macro-geographic analysis might then attempt to ascertain whether or not those facilities bombed or threatened by whites are located within the ghetto core, fringe, or transition zones. One might attempt to ascertain whether or not a racial factor is part of the motivational psyche of the white arsonist, bomb threatener, or bomber.

Another important question to be raised by macro-geographic analysis is whether or not the user population for illicit or quasi-legal activities such as prostitution, gambling, drugs, homosexuality, and various

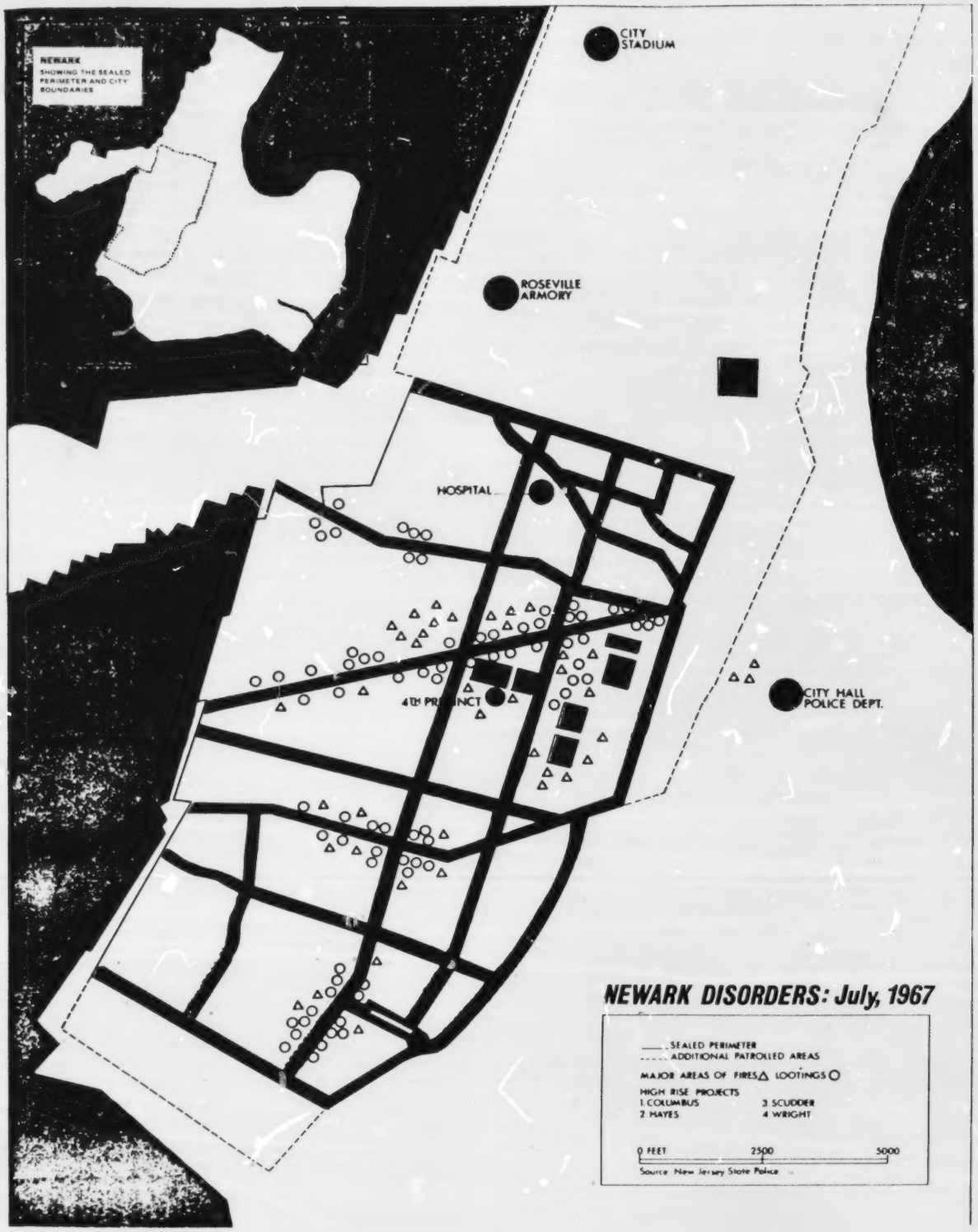

Figure 6. Source: Georges, 1975: 222.

other non-violent victimless sex crimes has easier access to the red-light districts than do the adjacent or nearby ghetto and slum-ghetto residents, e.g., note the location of the "Block" in Baltimore or the Times Square district of New York City. In both cases, mass transit nodes in the form of human "break-in-bulk points" such as bus routes, highway systems, street grid structures, or subway lines cluster at these points giving suburbanites rather than ghettoites easy access to these zones of ill repute. An equally significant question at this level of analysis is whether or not persons manifesting specific socio-economic characteristics who are suspected of having committed a statute crime (such as rape, murder, etc.), "type" neighborhoods in terms of the likelihood of detection, pursuit, apprehension, and punishment and thus select target are s after weighing these variables. Such a procedure might result in certain types of persons, suspected of certain types of crimes, who commit those crimes in one neighborhood while permanently residing in another. Harries (1974) provides a number of excellent graphic and cartographic displays based on macro-level analysis (Table 7; Figure 7).

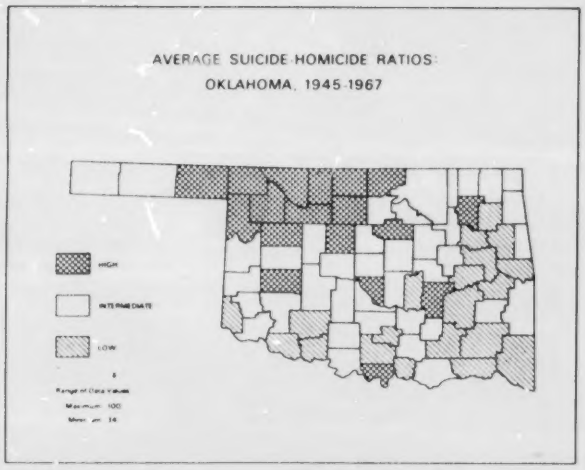

Figure 7. Source: Harries, 1974: 35.

TABLE 7. REGIONAL DISTRIBUTION OF MURDER CIRCUMSTANCES (%), 197

Region	*Spouse Killing Spouse*	*Parent Killing Child*	*Other Family Killings*	*Romantic Arguments*	*Other Arguments*	*Known Felony Type*	*Suspected Felony Type*
Northeast	9.5	4.3	4.7	5.6	40.3	25.4	10.2
North Central	11.3	3.2	9.4	5.4	38.2	24.8	7.7
South	15.3	2.4	10.4	7.6	45.5	14.0	4.8
West	13.3	5.7	6.5	5.4	36.9	23.9	8.3
TOTAL	12.8	3.5	8.4	6.3	41.5	20.4	7.1

Source: Harries, 1974: 32.

The Two-Level Approach

The two-level approach to the geography of crime enables us to analyze everything from individual acts of crime such as murders, rapes, or assaults, to "ecological struggles" such as range wars and other struggles for space. Research using these two levels of analysis might result in developing theories which contend that urban collective violence results from disputes over renewal projects, changes in ethnic or racial residential patterns, or locations of red-light districts and new highways. These are issues of social power centering on the use of space, and thus legitimately fall within the realm of the geography of crime. The spatial or territorial manifestations of these struggles might popularly be known as "badlands" or "no-man's-lands" by identifying them as "natural areas of crime and deviance" or perhaps as "zones of turbulence." In turn, the geographer might offer theoretical constructs which help explain the growth of such areas as the natural outcome of (comprehensible) dysfunctional factors in the process of growth, decline, or maintenance of the urban system.

III. ECOLOGICAL PRINCIPLES AND CONCEPTS APPLIED TO THE SPATIAL ANALYSIS OF CRIME

This chapter will survey the major ecological principles and concepts used by geographers and social ecologists, i.e., human ecology; symbiosis, community, and society; communications; slums; ghetto core, fringe, and transition zones; red-light districts and other zones of ill repute; the criminal's "typing" of neighborhoods in regard to the possibility of being detected, pursued, apprehended, or punished; the Distance Decay Function and other centrographic concepts; natural areas; and delinquency areas. Studying these concepts and principles and how social reasearchers use them should enable us to understand more fully such an unpopular thesis as the normalcy of crime in a delinquency area. Within the limits of the delinquent's social world and in terms of its norms and expectations, the delinquent may be a highly organized and well-adjusted person. The criminal behavior manifested by members of certain communities and neighborhoods is normative and thus should be expected.

Human Ecology

German biologist and philosopher, Ernst Haeckel, borrowed the term "ecology" from the field of biology around 1878. In 1895 the Danish botanist and social scientist, Eugenius Warming, developed or elaborated on the term in his book, *Plant Communities*. Warming noted that different kinds of plants tended to grow together, and, like human communities, had a temporal beginning, experienced changes, and finally entered into a decline, being gradually superseded by other plants. The adaption of the biological theory of ecology as a sociological theory is usually credited to Robert E. Park and his followers at the University of Chicago and the school of sociology which he founded.

This approach led to the formulation of such urban morphology schemes as Burgess' Concentric Zonal Hypothesis (see Figure 3). These theories and hypotheses posited the existence of certain regularities in the socio-cultural expression and diffusion of a city's activities, structures, and population groupings. In reviewing the monumental works of Clifford R. Shaw (1929) and Shaw and McKay (1942), Harries in his *Geography of Crime and Justice* (1974) applies the Burgess Concentric Zonal Hypothesis to the area of residence for male juveniles (Figure 8).

Symbiosis

Social ecology theory includes numerous functional and dysfunctional processes which are constantly interacting. Social ecologists used "symbiosis" to describe the living together of organisms of different species within the same habitat; such a relationship might be one of harmony or of conflict. They also used "biotic balance" to describe such relationships in which individuals exist in a state of equilibrium with other animate or inanimate objects and processes, i.e., when the harmonic relationships are balanced by those of conflict. Park (1921) believed that the aim of social or human ecology was to investigate the processes that maintain the biotic balance and the social equilibrium once they are achieved, and the processes that disturb the biotic balance and the social equilibrium when the transition is made from one relatively stable order to another.

McKenzie (1925, 1933), one of Park's protegés, viewed ecology as the spatial aspects of the symbiotic relations of human beings and human institutions (see Park *et al.*, 1925). He argued that social ecology aims to discover the principles and factors involved in the changing patterms of the spatial arrangement of population and institutions that result from the interplay of human beings in a continuously changing culture. He noted that institutional stability depended largely on the stability of space relationships. The works of Park, McKenzie, and others on the process of symbiosis developed the interest in the ecological concepts of community and society.

Community and Society

The social ecological concepts of community and society deal with the control and coordination that make a state of equilibriun possible. Social ecologists posited that in the human group these restraints are internal and moral, and are based upon some kind of consensus. Park used the character of the restraints as the criterion to distinguish between community and society (Park *et al.*, 1925).

According to Morris (1958: 6):

> The community exists only insofar as symbiotic competition has been limited or transformed by social control. The evolution of society in contrast has been the progressive extension of control over nature and the substitution of a moral for a natural order. In other words . . . . there is an essential distinction between symbiosis, on the one hand, and cultural or social processes on the other.

Communication

Social ecologists argue that communication is the essential feature of cultural relationships, for without it the social or moral order, the "consensus," could not exist. Thus, communication is always necessary if the continuity of the social order is to be ensured, just as it is a prerequisite of social change. Paradoxically, communication can bind a society together as well as rip it apart.

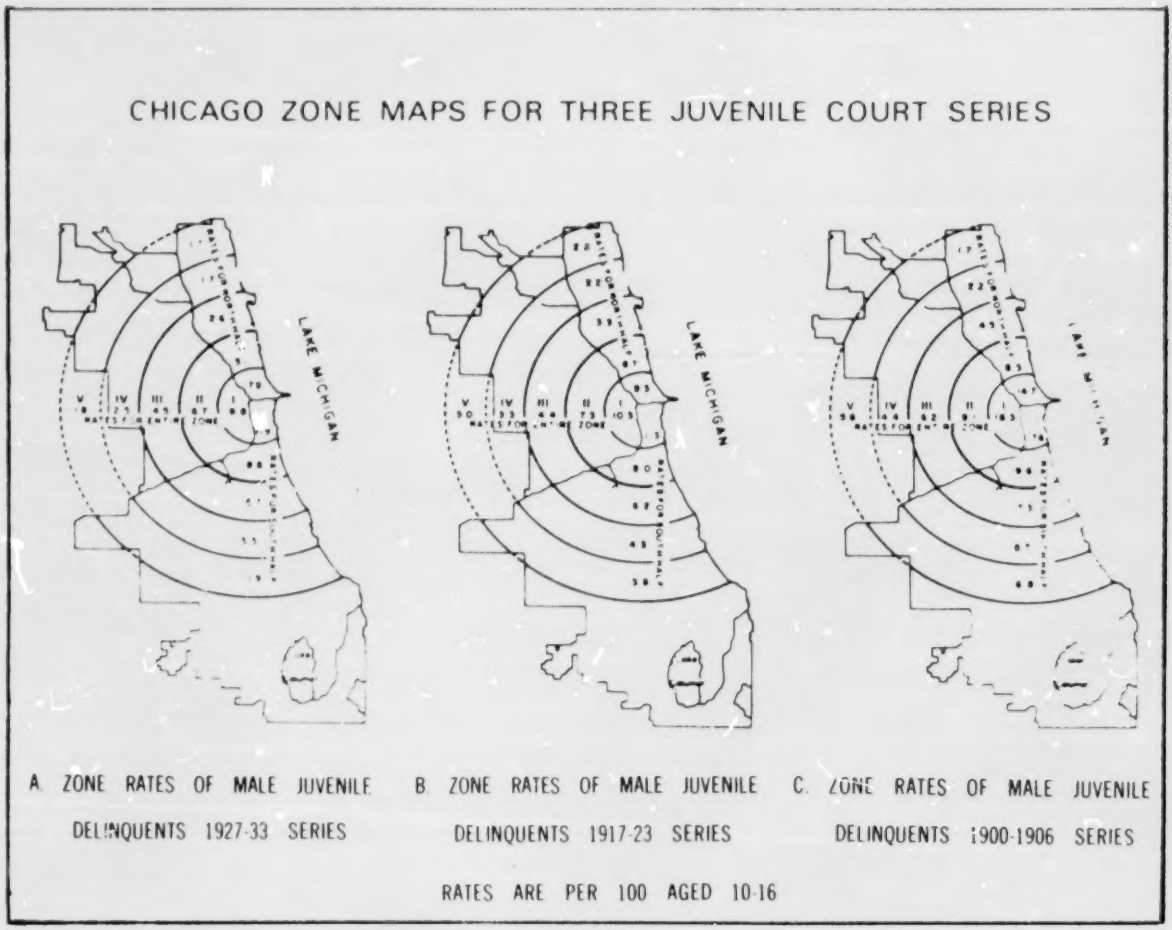
CHICAGO ZONE MAPS FOR THREE JUVENILE COURT SERIES
LAKE MICHIGAN
LAKE MICHIGAN
LAKE MICHIGAN
A. ZONE RATES OF MALE JUVENILE DELINQUENTS 1927-33 SERIES
B. ZONE RATES OF MALE JUVENILE DELINQUENTS 1917-23 SERIES
C. ZONE RATES OF MALE JUVENILE DELINQUENTS 1900-1906 SERIES
RATES ARE PER 100 AGED 10-16

Figure 8. Source: Harries, 1974: 62.

Theories of Urban Morphology

Ecologists and geographers recognized the existence of societal conflict and harmony, homogeneity and heterogeneity, and attempted to develop theories to explain these relative pockets of peace or turbulence, likeness or difference. The oldest of these theories, the Star Theory (or Axiate Theory), was developed by Richard M. Hurd in 1903 (Figure 9).

> Hurd observed that cities spread out from the center along transportation lines, thus creating an octopus or star shape. Eventually the interstices fill in, but always later than the points of the star; this observation was especially true before the advent of the automobile. (Thomlinson, 1969: 143)

An interesting application of the principles noted in diffusion models, such as Hurd's Star Theory (1903) was applied to a crime issue in Georges' (1975) study of arson during the 1967 Newark riot (see Figure 6). The fires and lootings tended to be more closely tied to main commercial thoroughfares than to abnormally high concentrations of blacks.

The second and best known ecological theory of urban morhpology is credited to Park and Burgess, al-

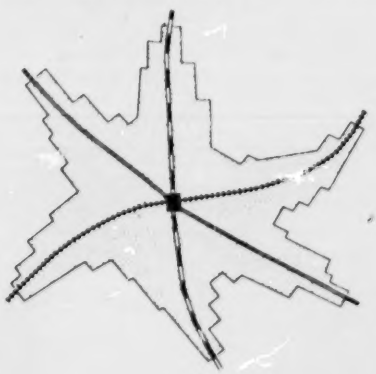

Figure 9. Model of the Star Theory of Urban Structure. Source: Thomlinson, 1969: 143.

though McKenzie's neighborhood studies of Columbus, Ohio in 1921 preceded the more famous study of Chicago (Park *et al.*, 1925). What is important is that these zonal studies formulated a scheme of dividing cities into concentric zones to illustrate the pattern of growth. This scheme posits that within such limitations as are imposed by topographic features, the city develops outward through successive zones resembling rings, with each ring exhibiting a unique interface between location and the social background of the population (either resident or working there).

The zone of transition is of special interest to the geographer (or social ecologist) of crime. It lies between the central business district and the zone of lower class an immigrant settlement, the zone of working class homes (see Figure 3). The zone of transition is one of mixed commercial and residential land use and is an area of physical deterioration and social disorganization. It contains the rooming-house district, the underworld dens, the brothels, Chinatown, and other distinct ghettos. Here crime and vice might be normal adaptive responses to dysfunctional social processes, cultural change, and urban expansion (or decline). A similar crime manifestation might be expected along the radial lines noted in the model of Hurd's Star Theory of social morphology.

Other important models depicting theories of urban morphology include those of Homer Hoyt's Sector Theory and C.O. Harris and E.L. Ullman's Multiple Nuclei Theory. The former visualizes the city as divided into pie-shaped wedges or sectors (Figure 10). "Essentially dynamic, it [the sector theory] portrays change rather than prevailing conditions" (Thomlinson, 1969; 146) by noting the dynamic interface among social behavior, urban growth and decline, and location. The Harris and Ullman theory model (Figure 11) depicts urban land-use patterns that develop not around a single city center but around several discrete nuclei. These theories are significant to the geographer of crime, for the same reasons as are the Concentric Zonal Hypothesis and the Star Theory.

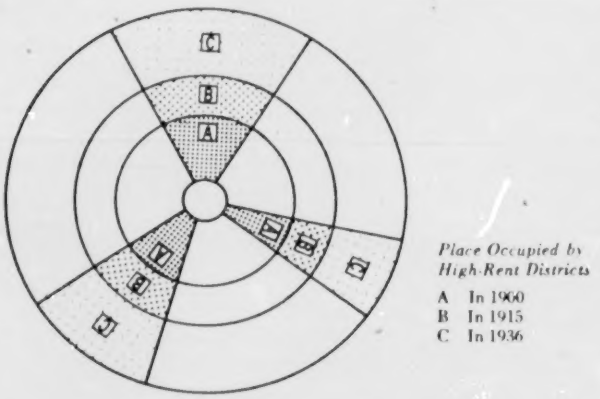

Figure 10. Model of the Sector Theory of Urban Structure. Source: Thomlinson, 1969: 146.

Various theories of social morphology developed by social ecologists and geographers attempted to locate and examine those spatial units which appeared to exhibit uniformities or irregularities in population, social processes, and institutions (both social and physical). Such schemes might help to explain the dynamics of the symbiotic relationship and the binding or disruptive effect of the communication process that exists within the urban context. As a result, geographers and social ecologists might comprehend more fully the dynamics of various forms of normative behavior, particularly the criminal behavior pattern, within specific locations.

The Natural Areas

Social ecological theory contends that the city is broken up into numerous smaller areas, the unplanned natural products of the city's growth. Social ecologists and social urban geographers call these "natural areas." Social ecological and geographic theory has tended to define these areas in two ways. Zorbaugh represents one orientation, McKenzie the other.

> Zorbaugh considers the natural area as essentially the product of patterns of land utilization modified by topographical and other special features peculiar to individual cities within the framework of zonal development . . . (Morris, 1958: 9)

Thus Zorbaugh's orientation offers a general zone built around a framework of transportation, business organization and industry, park and boulevard systems, and topographic features.

> McKenzie, on the other hand . . . defines the natural area in terms of the characteristics of its population,

Figure 11. Harris-Ullman Multiple-Nuclei Model of Urban Structure. Source: Harris and Ullman, 1945: 13.

> race, language, income and occupation; that is, as a cultural rather than a physical isolate . . . Burgess comes nearest to a synthesis of the two opposing views, for as he sees it, community life, as conditioned by the spatial distribution of population and institutions, has three distinct aspects, ecological, cultural and political. (Morris, 1958: 9)

For Burgess, there are three communities: (1) the ecological, i.e., the development of social relationships promoted or impeded by locational factors such as transportation facilities and geographical distance. These include the physical location and such end products of symbiotic competition as land use and the level of rents which tend to have a selective effect upon population; (2) the cultural, i.e., a social system or culture that arises within and characterizes a locale; (3) the political, i.e., political action isolates an area on the basis of location. For the geographer or social ecologist, the key to the utility of the natural area is its ability to formulate a scheme which conceptually isolates ecological, cultural, and political factors that are more closely associated with crime and vice than are other variables more uniformly distributed throughout a city. By identifying such a locale, the geographer or social ecologist has in essence located the delinquency area.

Delinquency Areas

Clifford Shaw (Shaw and McKay, 1931) in Chicago, is credited with first using the term "delinquency area" to designate those sectors of a city in which criminal and delinquent behavior appear to be as common and normative as vice, poverty, overcrowding, and disease. For Shaw, the delinquency areas are natural areas. They arise in the process of urbanization and growth and are noteworthy for their characteristic patterns of antisocial behavior.

Shaw believed that the delinquency area could be demarcated by delinquent or criminal behavior which is a norm of expectation among its inhabitants, although one would not expect all of the residents of the delinquency area to have a criminal or delinquent record. Other factors characteristic of the delinquency area include a hostile attitude toward social agencies and the police. This area comes to be a cultural enclave at odds with the rest of the city.

> Its formal characteristics are physical deterioration, overcrowding, a mobile population, and a proximity to the areas of industry and commerce. Its social characteristics are primarily a lack of informal agencies of social control, [i.e., ostracism, ridicule, corporal punishment, group pride, and group coercion] whereby the norms accepted by the wider society may be maintained. (Morris, 1958: 19)

Semantically, the delinquency area should be the area where the delinquent acts are committed. However, Shaw considered it primarily to be the area where delinquents live (Morris, 1958). It is necessary to distinguish between two types of delinquency areas: areas of commission and areas of delinquency residence (Figure 12). Geographers and social ecologists argue that the areas of commission and delinquency residence are essentially the same in the case of juveniles who reside in great cities, i.e., these areas may be geographically indistinguishable.

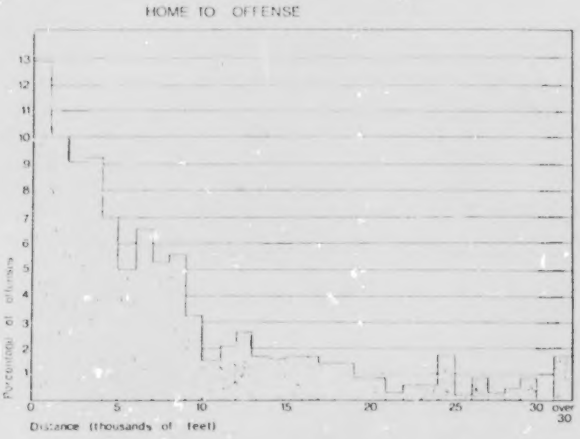

Figure 12. The Delinquency Areas: Area of Commission and Area of Criminal Residence. Source: Phillips, forthcoming.

The duality of the theory of the delinquency area also considers the role opportunity plays in fostering criminal or delinquent behavior. For example, this theory argues that

> One of the formal characteristics of the delinquency area is the proximity or presence of an unduly high proportion of commercial and industrial property—factories, warehouses and railway yards—which, in the absence of facilities for vigorous and exciting recreation, provide a constant source of temptation to youngsters to break and enter or pilfer, by way of compensation or substitution.[7] (Morris, 1958: 21)

For the social ecologist or urban geographer, the presence of physical temptations and opportunities in an area are as important as the absence of effective informal agencies of social control to an understanding of crime and delinquency. One should remember that such predisposing factors as the absence of social control, the presence of social contagion, a local criminal tradition, bad housing, a lack of adequate facilities for constructive recreation and lawful amusements, ethnic

[7] An interesting contemporary geographic exercise might be to determine if the frequency of crime commission actually increases rather than decreases as one approaches a youth-oriented recreation facility, in that petty property crimes such as vandalism, graffiti, and bicycle theft appear to be highly correlated with male adolescents. Thus, a youth facility might act as a nodal area for youth-oriented crime.

or racial heterogeneity, permissive systems of child rearing, coupled with the absence of one or more of the parents, the development of aggressive yet insecure personalities, and the presence of psychopathological individuals in the local population characterize a criminal or delinquent potentiality rather than actuality. These factors are correlative although not necessarily causative. Social ecologists and geographers also believe that in order to compare the incidence of crimes and criminals in different parts of the city, it would seem most useful to distinguish among areas on the basis of both physical features and general social and economic characteristics. They also posit that it is necessary to consider areas of crime commission on the basis of the types of crimes and types of criminals they attract, for example, the skilled professional or the youthful offender.

Delinquency Rates and the Population at Risk

The relevance of crime data to the incidence of crime commission or delinquency residence has been a central issue in social geographic and ecological treatises. Ecologists and geographers have usually calculated rates of offenders as the ratio of known offenders to the total population. Shaw called these delinquency rates (Shaw and McKay, 1931). However, social ecologists and geographers have warned that:

> It is not enough to calculate the rate as the percentage of offenders in the total population. For within that population will be numbers of very small children, sick, infirm and aged persons, and individuals incarcerated in institutions whose chances of committing offenses may be negligible or non-existent. Thus, in considering a given area, it is necessary to ascertain whether there are people's homes whose inmates might reasonably be excluded from the population at risk. (Morris, 1958: 26)

If FBI crime data are accurate, then the population at risk appears to be increasing, since the median or mean ages of first-time offenders are decreasing.

Geographers and social ecologists also believe that delinquency rates or crime rates are most meaningful if they divide the population into age groups. Such a process makes the exclusion of the young and the old easier. It also takes into account that the rate for the total population may mask important variations in the criminality of different age groups.

One final comment is in order regarding the calculation of delinquency rates and crime rates and the population at risk. Morris (1959) states that ecologists believe that percentage calculation is probably more useful for local rates than a proportion per thousand or hundred thousand. Although, ideally, comparisons between rates would be most accurate if the sizes of the local populations were standardized, such a calculation (while comparing populations of wards with similar sizes) fails to consider that proportions of their populations in different age groups may vary considerably.

Slums, Slum-Ghettos, Ghettos, and Ghetto Morphology

In order to understand the nature of delinquency areas better, it is useful to differentiate among slums, slum-ghettos, ghettos, and ghetto morphology (Figure 13).

Delinquency areas are traditionally viewed as slums and slum-ghettos, although social ecologists and contemporary geographers have argued that the demographic characteristics of ghettos are not constant in time or location. Thus, one should have a rudimentary knowledge of the social morphology of the ghetto if one is to understand its association with the delinquency areas.

Sociologist Robert E. Forman (1971:3) warns that

> although the terms slum and ghetto are frequently used interchangeably, they refer to different phenomena and should not be confused. A slum area is one of overcrowded poor-quality housing containing a subculture with a set of norms and values, which is reflected in poor sanitation and health practices, deviant behavior, and characteristic attributes of apathy and social isolation. Whereas residence in a ghetto is the result of racial or cultural characteristics, residence in a slum is determined primarily by economic factors . . . While slum implies poverty, this is not necessarily true of the ghetto . . . A slum ghetto would be an area inhabited by economically poor segregated minority-group members.

In brief, slums, slum-ghettos, and delinquency areas of residence share the same dysfunctional complex of socio-economic factors, although these are not always the areas of commission. For example, the residential burglary rate might be higher in a middle-class neighborhood than in a working-class neighborhood but this would not be common.

Social science researchers have demonstrated that the spatial dimensions of the ghetto are constantly changing i.e., expanding outward and on occasion contracting (Grodzins, 1958; Taeuber and Taeuber, 1965; Rose, 1971). The same researchers have also

Ghetto (minority-group area)
Slum (area of inadequate housing)
Ghetto: minority group members with adequate housing
Slum-ghetto: minority group members with inadequate housing
Slum: others with inadequate housing

Figure 13. Ghetto, Slum, and Slum-Ghetto. Source: Forman, 1971: 3.

noted the process of invasion-succession-invasion (interrupted by periodic contractions). Such a process calls for identifying relatively distinct intra-ghetto spatial distributions, frequently identifying them on a macro-level, e.g., the census tract. Harold M. Rose (1971: 6) presented such a scheme and posited that the

> question of appropriate population mix which justifies the use of a set of descriptive labels specifying the racial status of the population at a given date is not easily resolved. Like a number of previous writers, [he] will use the proportion of the population residing within a neighborhood at a given date to identify it as part of one social area or another. When the population within a given census tract equals or exceeds 50 percent, then the tract will be said to constitute a ghetto neighborhood. Ghetto core neighborhoods are represented by census tracts whose population is 75 percent or more black, with ghetto fringe neighborhoods having 50 to 74 percent of their population identified as black . . . Zones contiguous to the ghetto core and fringe, if they contain a black population that constitutes 30 percent [tipping point] or more of the total population within their domain, are thought to represent neighborhoods in transition. (Figure 14)

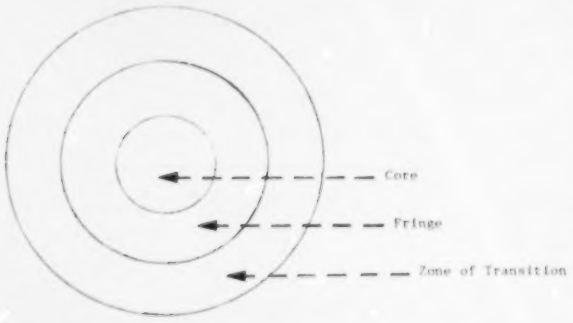

Figure 14. Ghetto Morphology. Source: Rose, 1971.

Rose's theory, like those offered by the Taeubers, Drodzins, and others, is essentially dynamic. The ghetto's spatial bounds change constantly. What was once the fringe might now be the core, whereas the new ghetto fringe occupies an area previously labelled the zone of transition. Of special significance to the geographer of crime are the symbiotic processes noted earlier with the possibility of the existence of dysfunctional factors that might result in a disproportionate rate of criminal behavior (be it deviant or normative for that zone) within one or more of the spatial units.

One might question whether or not the crime (and delinquency) rates decrease as one moves toward the ghetto core, that is, whether or not homogeneous population characteristics appear to have a controlling influence upon criminal or delinquent behavior. One should note, however, that the label of "black ghetto" implies a monolithic socio-cultural solidarity that might not exist. For example, most eastern and midwestern black ghettos are a mosaic of ethnic or racial groups ranging from Puerto Ricans to Cubans, West Indians, and southern and northern Afro-Americans, each with distinctive dialects, beliefs, customs, and consumption patterns. Thus, as the percentage of black population by census tract increases, the crime rate might increase, perhaps because the ethnic heterogeneity of the region increases while the overall racial composition becomes more homogeneous.

Red-Light Districts and Other Zones of Ill Repute

The geography or social ecology of crime might legitimately focus on the complex of socio-cultural-political variables which create and maintain red-light districts and other zones of vice and criminal deviance. Irving J. Sloan (1970), Willard A. Heaps (1970), and others have noted that certain types of ethnic ghettos (more specifically, the Chinese ghetto in the past) have often acted as red-light districts for the dominant white population. One can still legitimately state, without much contention, that the white middle class appears to use the services provided by such extralegal enterprises as prostitution, pornography, or other forms of illegal commercialized vice to a greater extent than do their non-white counterparts. If such enterprises are to prosper, then they must be located within easy access of the user population, yet not be close enough to alienate those with the political clout to destroy them. Such locations have traditionally been situated along the periphery of various ghettos, i.e., within the ghetto zone of transition. Geographic or social ecological studies of these delinquency or crime areas might help dispel the public misconceptions that center around the origin and maintenance of the spatial phenomena, i.e., that ghetto residents desire and support such enterprises, when in reality they are supported by groups other than the residents. For example, one might observe that the Times Square and the Lower East and West Side red-light districts of New York City border Hispanic ghettos, that Baltimore's infamous "Block" borders the black and low-income Italian ghettos, and that Boston's "Combat Zone" and San Francisco's red-light district border Chinese ghettos.

The Distance Decay Function and Other Centrographic Concepts

The "distance decay function," a proposition which notes the strength of the relationship of the service areas of two sites (or urban forms), has been applied to both the geography of crime and the social ecology of crime. The social ecological concept of delinquency areas—the area of delinquency residence and the area of delinquency commission—is an application of this function. Delinquents might reside in one area, yet commit certain types of crimes within a different spatial locale. The strength of such a relationship might be even greater if one notes the zones of residence and of commission for adult or professional criminals. Recent work by Phillip Phillips, George Rengert, Ron Carter, Gerald Pyle, and Larry Stephenson (in Georges and Harries, unpublished manuscript), documents the utility

of centrographic concepts in analyzing adult crime or juvenile delinquency. These studies note that delinquents and criminals will travel further in order to commit certain types of offenses than to commit others (or that the social and physical dynamics of certain types of criminal behavior patterns are firmly tied to the offender's place of residence or the areas in close proximity to it). These authors also posit that certain adult criminals and juvenile delinquents often engage in a "rational" process of site selection that takes the following variables into account: the likelihood of detection, pursuit by social control agents, and vigorous judicial processing which might result in a severe sentence.

Concluding Statements

Both geographers and social ecologists of crime often use the same or similar conceptualizations of man-environment relationships, with the qualification that geographers rely less on some (but not all) of the organistic metaphors of the social ecologists. One can state that the contemporary geography of crime does make use of all of the concepts cited in the previous section. Thus, the essential difference between the geography of crime and the social ecology of crime lies not so much in the conceptualization of the human-space relationship as in the data sources and the statistical procedures used to analyze the crime data.

IV. CRIME DATA SOURCES AND GENERAL GROUND RULES FOR STUDYING THE GEOGRAPHY OF CRIME

Earlier we mentioned that the primary units for social ecological studies were the delinquency areas themselves. Information sources included systematic observation or reliance upon data (usually arrest records) provided by local social control agencies such as the police or a juvenile control authority, e.g., the municipal Department of Juvenile Services. Contemporary researchers are no longer limited to using data provided by local municipalities, since various federal agencies take censuses of various dimensions of the criminal population. These new data sources share at least one monumental shortcoming, that of scale. They all tend to present crime and delinquency data on a macro-scale and it is virtually impossible to make micro-level inferences based upon these data sources. Unfortunately, many of these data sources tend to be depositories of inaccurate data provided by state and local control agencies. In addition, the various official data sources which follow (Galliher and McCartney, 1977: 331) have been shown to be beset with technical problems as well as with many potential distortions because of political pressures. Moreover, the official crime rates show little or nothing about the actual behavior from which they have been constructed because they provide information on an aggregate level.

> . . . various measures of criminal behavior . . . can be evaluated not only in terms of their representativeness of such behavior, but also in terms of their use in forming public policy decisions, their intrinsic human interest, and their use as a basis for law-and-order rhetoric and as a vehicle for judging the efficiency of the various elements of the criminal justice system. (Galliher and McCartney, 1977: 332)

When selecting a data source one must ask not only what the data reveal but also why they were collected originally. One should also recall the significance of the principle of population at risk when applying statistical procedures or inferring from the data or statistical manipulations (see Footnote 1). Galliher and McCartney (1977), Reid (1976), and Quinney (1975) offer excellent reviews of the possible biases built into the most common criminological data sources.

The following is a listing and critique of a number of the data sources frequently used by geographers and other social scientists who study the incidence of crime within the United States.

Federal Reports

Since 1930, the United States Department of Justice has published a periodical bulletin on crime statistics, *Uniform Crime Report: Crime in the United States*. This publication presents data on the incidence of major crimes (murder, forcible rape, aggravated assault, burglary, robbery, larceny, and automobile theft) and the arrests reported to the FBI by the police of about 3,000 cities and towns.

First published monthly, the bulletin became a quarterly in 1932, was converted into a semiannual publication during World War Two, and became an annual publication in 1959. Local police departments are supplied with a manual on reporting, but participation by police departments is on a voluntary basis. Consequently the bulletin does not cover all communities and the large metropolitan centers are over-represented. Although the *Uniform Crime Report* has many limitations, and the FBI will not vouch for the accuracy of the statistics it presents, it is still the most comprehensive statistical report available on crime in the United States.

The Law Enforcement Assistance Administration (LEAA), an arm of the Department of Justice, publishes numerous macro-level studies on the dynamics of criminal victimization. These publications are usually in the form of special topic monographs, although computer tapes are available. The LEAA in conjunction with the U.S. Bureau of the Census also conducts peri-

odic surveys of victimization in major cities in an attempt to get a more accurate picture of the dynamics of the criminal victimization process in the United States. These victimization studies document the extent of the underreporting of crime and suggest explanations for that underreporting. The data provided by means of the anonymous questionnaire format used by the LEAA is believed to be more accurate than that contained in the FBI's *Uniform Crime Report*.

In 1965, the National Opinion Research Center (NORC) surveyed 10,000 households and found that the crime rate was twice as high as had been indicated by the FBI statistics. Its data were presented in a macro-level format; the smallest units were municipalities. The results of other more recent NORC surveys, which have also used the anonymous questionnaire format, have acted to undermine seriously the credibility of the FBI surveys.

Other sources of macro-level crime data are the National Office of Vital Statistics' *Vital Statistics of the United States* (which contains homicide rates) and the U.S. Public Health Service's *Statistical Abstracts*. One must exercise extreme care when inferring from either of these data sources

> because they do not report the portion of all homicides which are justifiable or due to negligence; the publication tells us little about trends in murder, as popularly understood. It should be noted further, that [the local] coroner's reports [from which they are compiled] pertain to medical causes of death and not to arrests or prosecutions of persons accused of murder. (Sutherland and Cressey, 1974: 34)

Statistics on juvenile delinquency are also published by the federal government through the Children's Bureau of the Social Security Administration.

> Until 1955, only about 400 courts, out of approximately 3,000 courts that deal with children's cases, made reports to the bureau. In 1955, the bureau revised its statistical reporting plan to include a national sample representative of all juvenile courts. (Sutherland and Cressey, 1974: 35)

State Reports

Sutherland and Cressey argue (1974: 36–37) that generally the states are less efficient than the federal government in making crime statistics available. In most states, one or more state departments obtains reports from a particular type of county or municipal official, but makes no attempt to use a uniform system of reporting in order to make the resulting summaries comparable. Only thirteen states have central statistical bureaus which collect and publish statistical information drawn from reports made by a variety of local, county, or state agencies. Some states summarize crimes known to the police, arrests, and convictions, but most states restrict their statistics to the number of persons admitted to probation, prison, and parole.

Other Reports

In addition to those mentioned above, some federal and state agencies regularly compile and publish statistics on specific crimes and their location (often in a case-by-case format). Certain private organizations also maintain running accounts of the offenses committed against them. For example, the American Bankers Association keeps records of offenses against banks; the National Board of Fire Underwriters and the International Association of Arson Investigators compile information on arsons; and large corporations record their annual losses from various kinds of crime.

During the search for micro-level data, one should not neglect to seek data from such varied sources as hospitals (excellent for information on illegal or questionable stabbings and shootings), the office of the local district attorney, police research and planning departments (which include police offense and arrest reports as well as information on police calls and computer tapes), and police data from various "street" departments such as Vice, Offenses Against the Person, Person, Homicide, and Burglary.

General Ground Rules

Once a data source has been identified, the researcher should follow some general ground rules, i.e., procedural rules or formats that structure the geographic analysis of crime:

(1) Make sure the subject to be studied is expressed in spatial form or can be analyzed from a spatial perspective.

(2) Ascertain whether the material to be examined and analyzed is capable of being expressed by means of cartographic techniques, i.e., by charts and/or maps. Appropriate mapping techniques may include the following:
   (a) dot maps, e.g., showing the actual geographic location and distribution of offenders or incidents; see Figures 6, 15–18.
   (b) rate maps, e.g., showing the variation in rates between the square mile areas or some other spatial unit; see Figures 19–21.
   (c) radial maps, e.g., showing variations in crime or delinquency rates of "gradients" drawn from the city center; see Figures 4 and 8.
   (d) zone maps, e.g., showing the averages of the rates in the square mile areas or some other spatial unit; see Figure 8.

(3) Distinguish clearly between crime and violence. "Crime" is a socio-political-judicial entity, something not sanctioned either by custom or by law, whereas "violence" is a physical reality

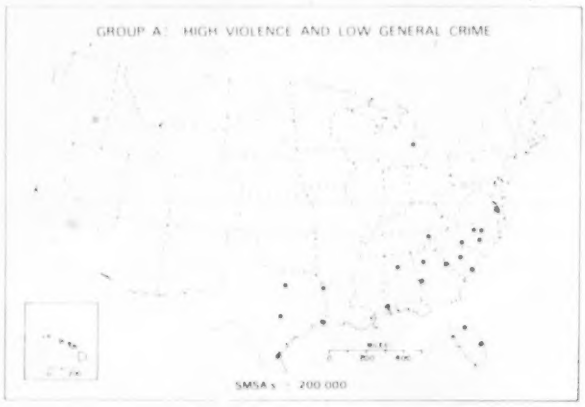

Figure 15. Source: Harries, 1974: 53.

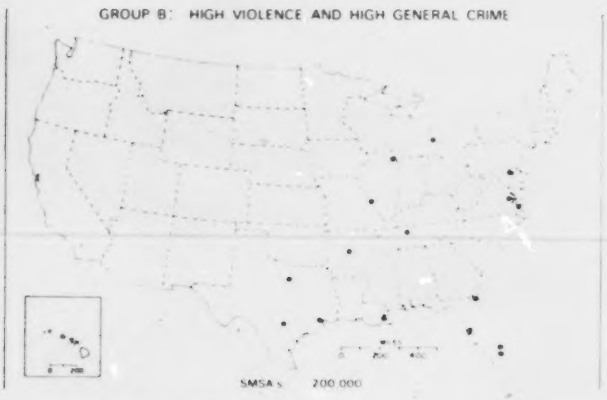

Figure 16. Source: Harries, 1974: 53.

Figure 17. Source: Harries, 1974: 54.

Figure 18. Source: Harries, 1974: 54.

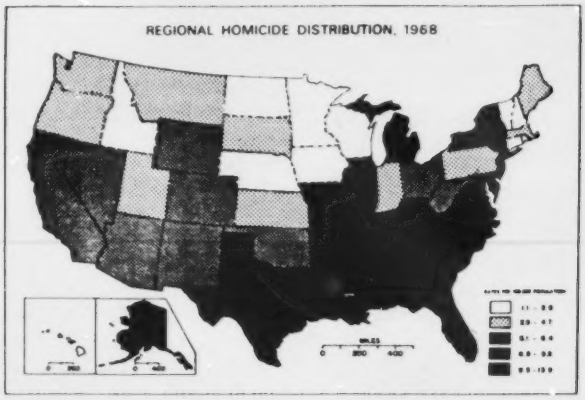

Figure 19. Source: Harries, 1974: 22.

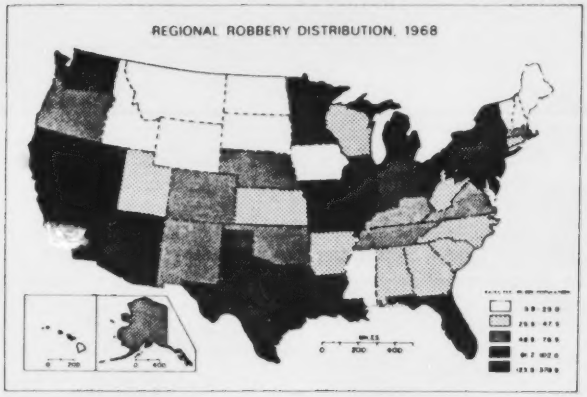

Figure 20. Source: Harries, 1974: 23.

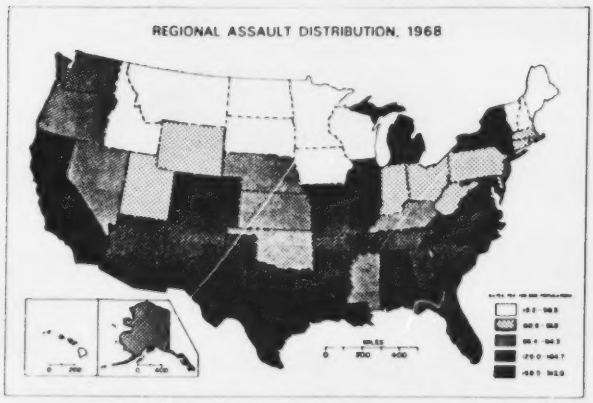

Figure 21. Source: Harries, 1974: 23.

expressed by means of physical force and resulting in either physical injury or damage to a living creature or to an inanimate structure or object. An act of violence, although destructive by nature, might not necessarily result in the violation of a law or in the commission of a crime, e.g., every fire is not necessarily an arson, every fight not necessarily an assault, every taking of a life not necessarily a murder.

(4) Seek the smallest scale possible for analysis to provide more detail and to refine the study.

(5) Use "suspect" data when available, rather than "arrest" data. Suspect data, although at times inaccurate, is not biased by the plea bargaining procedure which is initiated during the first encounter between the suspect and officer on call and is culminated in the trial judge's chambers or courtroom. This procedure is tainted by the biases of economic and social class, race, ethnicity, and a thousand other peculiarities harbored by the various protagonists. Suspect data provided by the research and planning divisions of the various police departments or the tape of police calls (at times, supplemented by the officer's report, when an arrest was not made) serve adequately as the primary data source. In brief, arrest records or arrest reports should be used sparingly. When one uses such data, one should note the drastic effect they might have on the mapping of the spatial occurrence of crime and violence. In fact, one's perception of the incidence rate of crime and violence might be quite different from the official arrest data, i.e., the crime rate.

One should, however, view the previously cited general ground rules for the study of crime in the manner in which they are intended, simply as a suggested format when attempting a spatial analysis of crime. There are no hard and fast dictums or required research methodologies that are more powerful and prestigious than others to dictate policy in this old but amazingly underexplored field of inquiry.

V. CONCLUSION

The objectives of the geography of crime are to describe and map the spatial distribution of crime in greater detail and meaning than has been done before. This field of research attempts to relate the spatial patterns of crime to the environmental, social, historical, psychological (cognitive), and economic variables that may explain these patterns. It hopes to develop associational and predictive models that explain crime manifestation in regard to locale. Last but not least, it is hoped that its contribution to the analysis of the dynamics of crime manifestation will help those charged with the responsibility of crime control to assess better the effectiveness of programs they currently use.

VI. CENSUS TRACT EXERCISE

This chapter provides an exercise in the application of scattergrams and regression analysis to a crime issue.[8] The exercise is modeled closely after John Fraser Hart's (1972) extremely useful application of regression analysis to the relationship of quality housing, owner occupancy, and age of housing in the Twin Cities of Minnesota.

A word of caution is necessary before beginning the exercise. Anyone familiar with the Twin Cities of Minnesota will recognize that we are taking great liberties with the use of data as presented in the Appendix, especially the values in Columns A and B. For example, Census Tract ED-36 (see Figure 22) is part of a mature suburban area, Edina. According to the 1960 *Census of Population and Housing* (see Appendix, Tract ED-036), this census tract had one hundred percent (Column A) of its housing classified as sound (in this exercise, the one hundred percent will now represent the percentage of housing units containing occupants with a delinquency/criminal record); ninety-three percent (Column B) of the housing units were occupied by the owners (in this exercise, the ninety-three percent will represent the percentage of housing units with incomes above the poverty line); and seventeen percent (Column C) of the housing units were built since 1950 (this is the only variable whose meaning will remain the same as in Hart's exercise). Thus, when performing this exercise, it is important to focus upon the methodology and reasoning outlined rather than to relate the findings to the actual situation in the Twin Cities.

For this exercise we will use three variables (see

[8]Regression analysis is a statistical method that considers the *form* of the relationship between two (or more) variables. It may be merely a summary expression of the relationship between two variables or a way of highlighting individual deviations (residuals) from this relationship; or it may be used to interpolate or predict unknown values of one variable from known values of the other. Scattergrams and regression lines commonly are used to chart the relationship between two magnitude variables, neither of which is plotted at evenly spaced intervals.

Appendix): Column A—the percent of housing units in each census tract containing occupants with a delinquency or criminal record (the dependent variable); Column B—the percentage of housing units in each census tract with incomes above the poverty line (an independent variable); and Column C—the percentage of housing units in each census tract built since 1950 (an independent variable).

Materials

Materials required for this exercise include:

(1) the *1960 Census Tract Report* for the Minneapolis-St. Paul metropolitan area contained in the Appendix.[9]
(2) tracing paper or onionskin paper
(3) graph paper
(4) colored pencils
(5) masking tape for attaching tracing paper overlays to the census tract base map.

The Problem

The research problem for this exercise is to explain geographic variations in the association between the area of criminal/delinquency residence and the quality of housing in the Twin Cities. In other words, we wish to examine the relationship between the area of criminal/delinquency residence, the dependent variable (whose distribution we wish to "explain"), owner-occupancy, and age of housing, the independent (or "explanatory") variables. See Figure 22 for a census tract map of the study area.

Step One: Distribution of the Dependent Variable

The first step in "explaining" the geographic variations in the distribution of the dependent variable is to describe those variations as precisely as possible by portraying them on a map. How does one transform a column of figures (Column A, Appendix) into a map (Figure 23)?

Plotting the Data

Place a sheet of onionskin or tracing paper over the census tract map. Find the number of a census tract on the map, and look up the area of criminal residence value for that tract. (For example, census tract GV-016, the first tract listed in the first column in the Appendix, has an area of criminal residence value of ninety-six percent, as indicated in the second column under the letter A.) Plot the value for each tract neatly within the boundaries of that tract on the overlay sheet.

Selecting Class Intervals

Place a second sheet of onionskin or tracing paper over the sheet on which you have plotted the values for each census tract and use it to prepare a map showing the geographic variations in criminal residence. Use a gradation of four or five colors to identify four or five roughly equal-sized groups of tracts that have a similar area of criminal residence values. (The map contains parts of ninety-nine census tracts, so each group should consist of about twenty-five tracts if four colors are used, or twenty if five colors are used.)

Begin with the tract that has the lowest value, and color it with the lightest color. Apply the same color to the tract with the next lowest value, and build up in this fashion until a pattern begins to emerge, or until you have colored a group of the desired size. Then shift to the tract with the highest value, color it with the darkest color, and build down in the same fashion. Groups of tracts with intermediate values are relatively easy to identify once you have established the pattern of extreme values.[10]

"Explaining" the Distribution

After you have completed the map of the area of criminal residence, you should be ready to suggest working hypotheses that might help to "explain" the patterns. Attempt to come up with some working hypotheses before reading further.

Step Two: Independent Variables

Working Hypothesis

The first working hypothesis might assume that households above the poverty line are less likely to have family members with a criminal/delinquent record than households below the poverty line, and that variations in the crime area can best be "explained" by variations in the percentage of housing units which are

[9]You can substitute a Census Tract Report of an SMSA in your region, thereby making this exercise more closely related to your situation, although we are distorting reality by substituting different variables for the quality of housing and owner occupancy. If you wish to obtain the kinds of crime-related data (specifically in Column A, Appendix) that will give you a more realistic situation, it will be necessary to locate cities with Geographic Base File applications. The cities most likely to have Geographic Base File information would include the so-called high-impact cities, i.e., Atlanta, GA, Baltimore, MD, Dallas, TX, Denver, CO, Los Angeles, CA, New York, NY. Some non-high-impact cities have also moved to computerized systems that also make use of the Geographic Base File, e.g., Fort Worth, TX, Oklahoma City, OK, and Tulsa, OK.

The Geographic Base File is a computerized record system that attempts to note the spatial occurrence of criminal victimization and social, economic, statistical, and status variables. Such systems will include the location (site) of the incident as well as the situational variables such as the place of residence for the criminal or delinquent and the site of the act of criminality (centrographic information).

The Geographic Base File uses the following types of spatial recording units: police report area, police census tract, police beat, and federal census tract. Once the street location is noted, the investigator will be able to associate both police information in the form of police census tracts, beats, or report areas with federal government statistical information in the form of census tracts.

[10]It should be noted that this is an arbitrary way of selecting class intervals and that the resulting map might not display as accurately as desirable the different areas. For the purposes of this exercise, the method of selection should be sufficient. For a brief discussion on classification and choroplethic maps, see Mark Monmonier, *Maps, Distortion, and Meaning*, Resource Papers for College Geography, No. 75–4, Washington, D.C.: Association of American Geographers, 1977, pp. 25–34.

occupied by households above the poverty level (Column B, Appendix).

Another working hypothesis might assume that newer houses are in better shape than older ones, and that variations in the area of criminal residence can best be "explained" by the percentage of housing units built between 1950 and 1960, in the decade immediately preceding the census from which we have taken our data (Column C, Appendix).

Now prepare maps of the two independent variables (the procedure is the same as you used in preparing the map of criminal residence, Figure 23) and compare them with the map of the percentage of households above the poverty line and age of housing in an attempt to decide which provides the best "explanation" of the variations of the first map (Figures 24 and 25).

Step Three: Scattergram and Regression Analysis

The first step in this statistical analysis of geographic data is to prepare a scattergram on which each dot represents one unit of analysis (in this case, one census tract). Plot the value of the dependent variable (area of criminal residence) in that tract against the Y (vertical) axis, and then plot the value of the independent variable (households above the poverty line or age of housing) against the X (horizontal) axis (Figures 26 and 27).

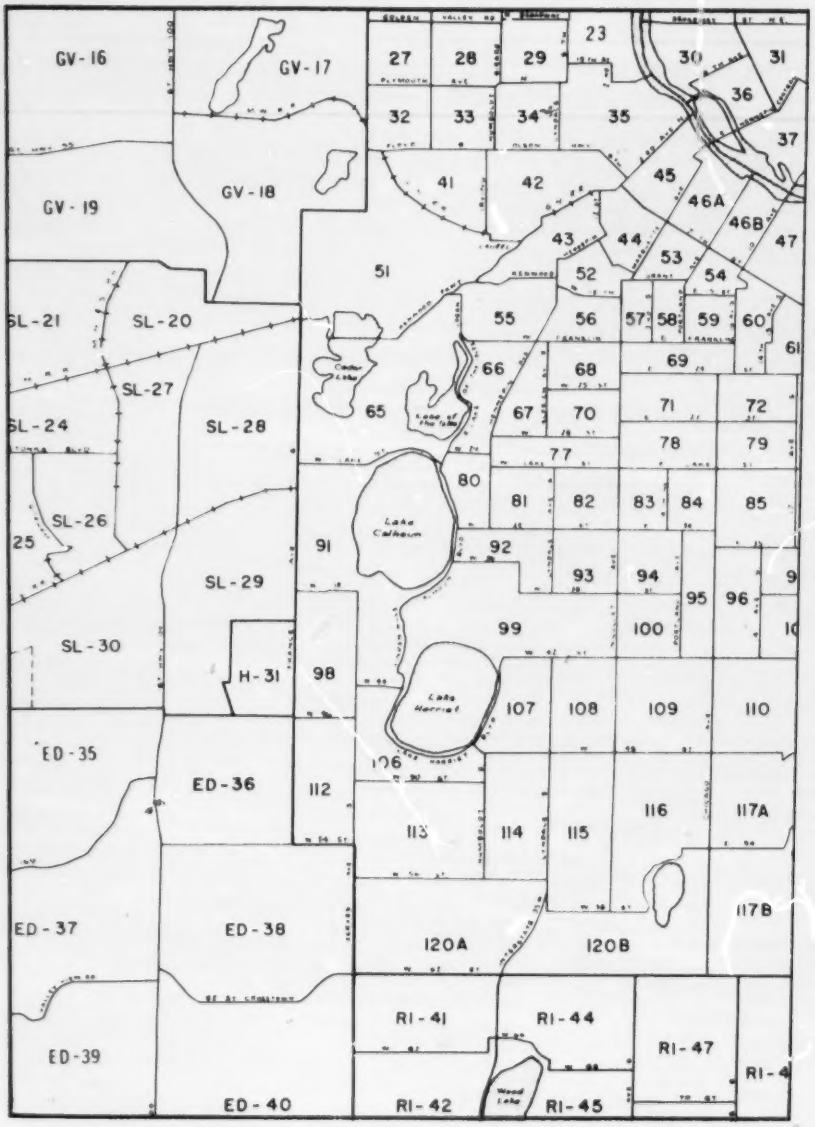

Figure 22. Census Tract Map of Minneapolis–St. Paul. Source: Hart, 1972, 325. Reprinted by permission of the *Journal of Geography*, National Council for Geographic Education.

Area of Criminal Residence and Age of Housing

Most of the dots on the scattergram of the area of criminal residence and age of housing will be strung out along the top and left sides. The dots across the top indicate that the tracts in which more than ninety percent of the housing units have at least one person with a criminal record are also tracts in which more than ten percent of the housing units have been built since 1950 (see Figure 26). The dots down the left side indicate that the tracts in which less than ten percent of the housing units have been built since 1950 are also tracts which have a wide variation in the percentage of housing units having at least one person with a criminal record. One might conclude that 1) the area of criminal residence is not very closely related to the age of housing units in tracts where less than ten percent were built before 1950, and 2) most of the housing units with at least one person with a criminal record are located in tracts where more than ten percent of the housing units have been built since 1950. Such findings strongly suggest one or both of the following: 1) that the "culture of poverty explanation" of crime (which states that poverty leads to differential association and subsequent learned criminal behavior) might not be tied to the criminal's place of residence if older units might be used as an index of poverty; 2) that the age of a housing unit, i.e., built before 1950, is a poor index of poverty, and thus does not challenge the "culture of poverty explanation" of crime.

Area of Crime Residence and Households Above the Poverty Line

The scattergram for the area of criminal residence and the area above the poverty line has a cluster of dots

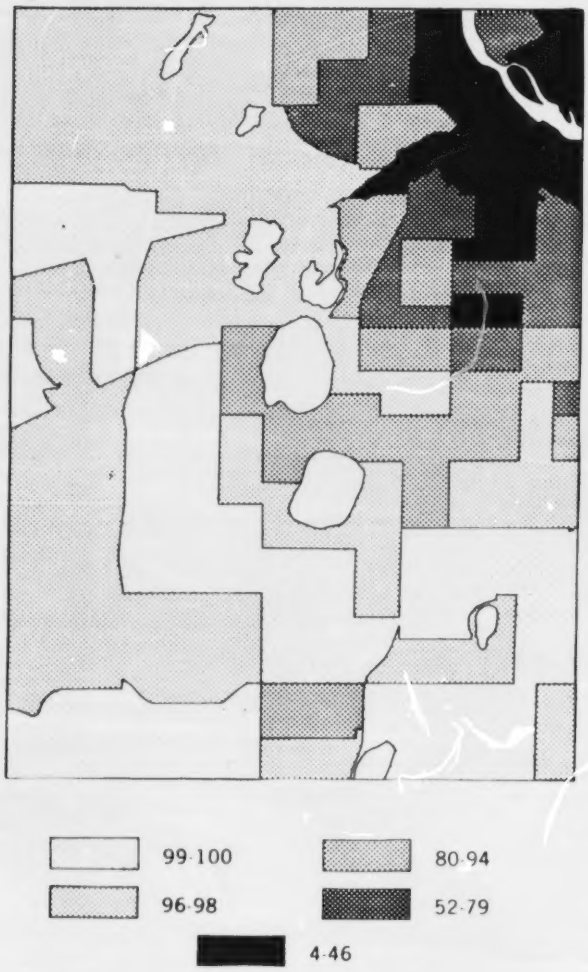

Figure 23. Percentage of Housing Units with Occupants with a Delinquent and/or Criminal Record. Source: Based on Hart, 1972: 330. Reprinted by permission of the *Journal of Geography*, National Council for Geographic Education.

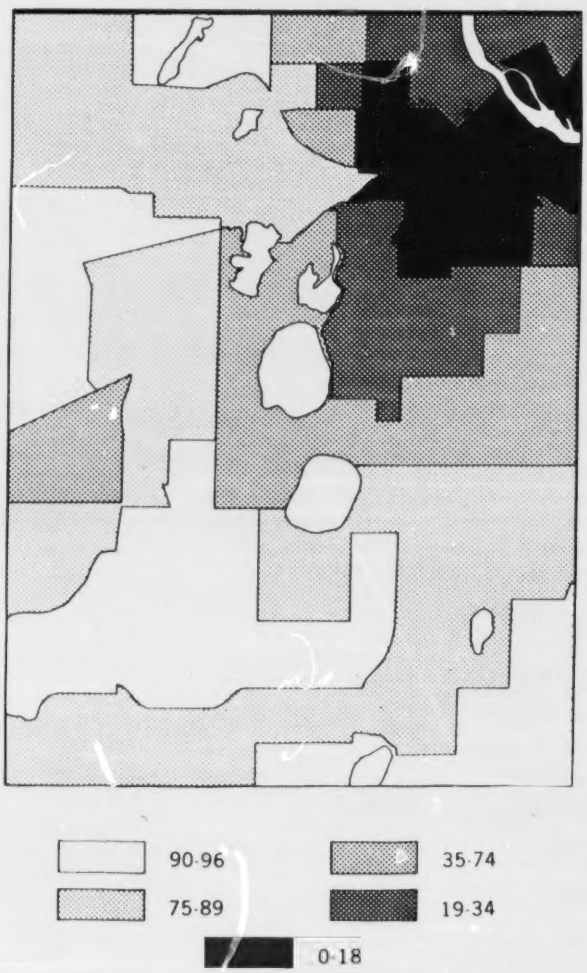

Figure 24. Percentage of Housing Units Above the Poverty Line. Source: Based on Hart, 1972: 332. Reprinted by permission of the *Journal of Geography*, National Council for Geographic Education.

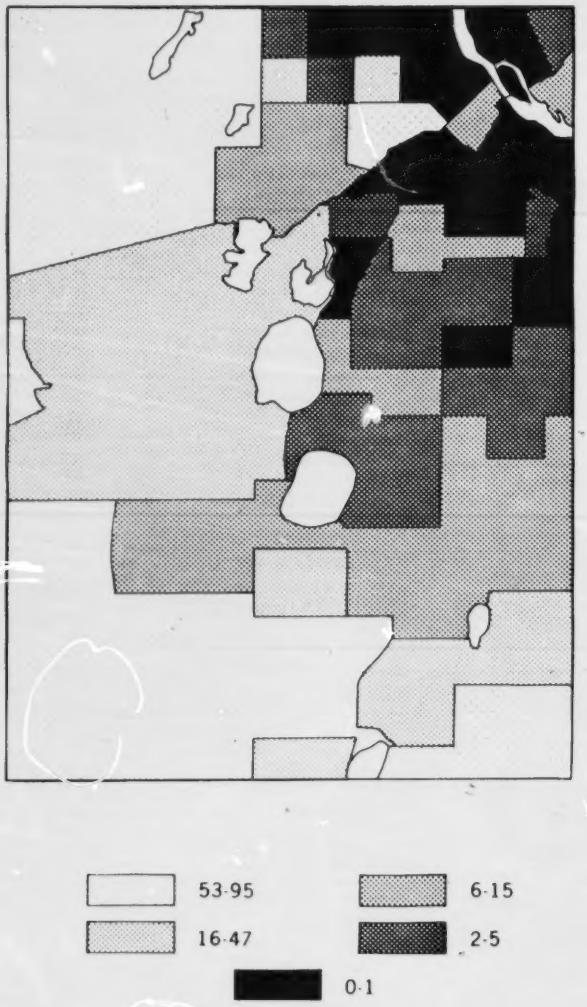

Figure 25. Percentage of 1960 Housing Units Built Since 1950. Source: Hart, 1972: 333. Reprinted by permission of the *Journal of Geography*, National Council for Geographic Education.

in the upper right-hand corner, and the dots tend to be lower toward the left-hand side (Figure 27). This pattern indicates that the census tracts that have a high value for the area of criminal residence have a high percentage of families above the poverty level, and the percentage of families with a crime record tends to decline as the percentage of families above the poverty level declines. When the values of two variables decline together (or regress upon each other), it is not unreasonable to assume that they have some degree of statistical relationship to each other, and that the variations in one will "explain" the variations in the other, or vice versa. In this instance, although the relationship is comparatively weak, one might argue that variations in the percentage of units above the poverty level "explain" some portion of the variations in percentage of families with at least one member with a criminal record. One might again argue that the "culture of poverty

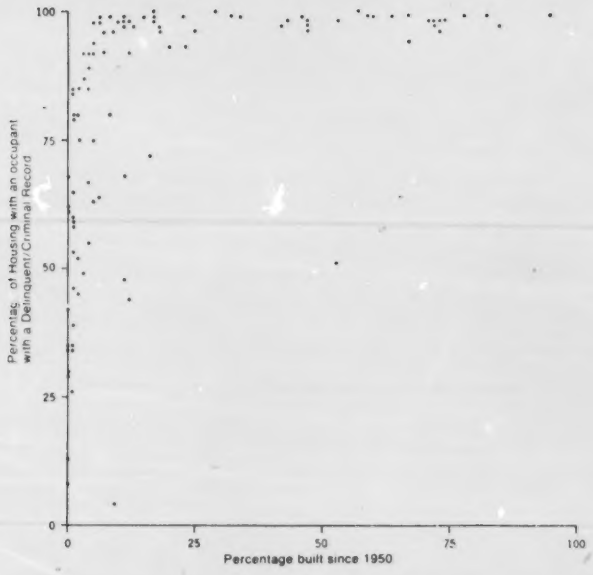

Figure 26. Graph of Percentage of Housing Units Built Since 1950 and Percentage with a Criminal Record. Source: Based on Hart, 1972: 334. Reprinted by permission of the *Journal of Geography*, National Council for Geographic Education.

explanation" of crime which states that poverty (in this case indicated by low income, i.e., income below the poverty line) is positively correlated with the place of criminal residence (which according to the logic of this theory, is where the criminal is socialized and inculcated with criminal norms) is indeed faulty. However, those who hold steadfastly to this theory might counter by saying that poverty and crime residence are positively associated, but that income above the poverty line does not mean that one is not poor, but rather that the poverty line needs to be adjusted upward.

Coefficient of Correlation

The logical next step would be to calculate the overall degree of statistical relationship between the two variables. The standard index used for this purpose is the coefficient of correlation ("r"), which has a value of 0.82 for the relationship between the area of criminal residence and percentage of families above poverty. The coefficient of correlation ("r") is a measure of the overall degree of relationship between the two variables for all census tracts. However, we are more interested in the confidence with which we can predict the percentage of families with at least one person with a criminal record in any given census tract if we know the percentage of families above the poverty level in that tract.

The Regression Line

If a perfect relationship existed between "homes with at least one member with a criminal record" and "the percentage of families above the poverty line," (that is, if the percentage of families with a criminal record

in each census tract were determined by the percentage of families above the poverty level), all the dots on the scattergram would form a single straight line, and we could use one variable to predict the other. If we knew the percentage of families above the poverty level in a given census tract, for example, we could determine the percentage of families with a criminal record in that tract simply by locating the appropriate dot on the scattergram. Although the relationship between families with a criminal record and households above the poverty level is far from perfect, we can nonetheless use these principles to identify the census tracts where a given relationship between the two variables appears to be valid, and those in which it breaks down.

The first step is to draw the straight line which passes closest to the largest number of dots on the scattergram. Such a "regression line" has been drawn on the scattergram for the criminal area and percentage of households above poverty status (Figure 28).

The distance between the regression line and a given dot on the scattergram indicates the degree to which the general relationship between criminal residence and being above the poverty level for the entire area fails to predict the value of criminal residence for the census tract represented by that particular dot. It would be quite simple to measure the actual distance on the graph. An easier procedure is to estimate the mathematical formula for the regression line and to use this formula to predict the value of criminal residence in each tract.

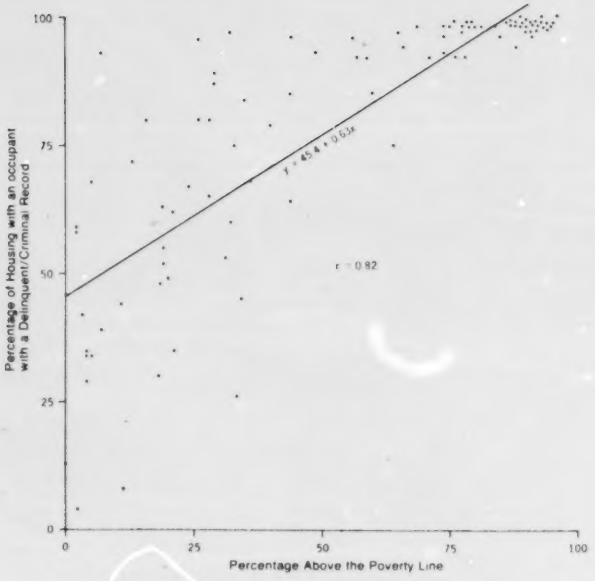

Figure 27. Graph of Percentage of Housing Units Above the Poverty Line and Percentage with a Delinquent/Criminal Record. Source: Based on Hart, 1972: 335. Reprinted by permission of the *Journal of Geography*, National Council for Geographic Education.

The Regression Formula

The mathematical formula for a straight line is $Y = a + bX$. Y represents the value of the dependent variable (criminal residence), X represents the value of the independent variable (above the poverty level), a represents the value of Y when the value of X is zero (hence a is called the "zero intercept"), and b indicates the number of units by which the value of Y increases when the value of X increases by one unit (b is called the "slope" of the regression line).

It might help to look at a graph of a specific regression line (see Figure 28). Possible values of Y (criminal residence) run from 25 to 100 on the vertical axis, and possible values of X (above the poverty level) run from 0 to 100 on the horizontal axis. The diagonal regression line meets the vertical axis (which has a value of zero on the X scale) at a value of 45 on the Y scale; this indicates that the value of a, the zero intercept, is 45. Next, measure off ten units on the horizontal, or X axis; the ten units between the values 50 and 60 are shaded on the graph. How much does the value of Y increase when the value of X increases by ten units? Y has a value of 75 when the value of X is 50, and a value of 81 when the value of X is 60, which indicates that the value of Y increases by six units when the value of X increases by ten units. This is another way of saying that the value of Y increases by 0.6 units when the value X increases by one unit, and determines that the value of b, the slope of regression line, is 0.6.

We have now determined that the formula for our regression line is $Y = 45 + 0.6X$, i.e., the value of Y (percentage of homes with a criminal record) for any given census tract can be determined (if our relationship is valid) by multiplying the value of X (percentage of homes above the poverty level) by 0.6 and adding 45.

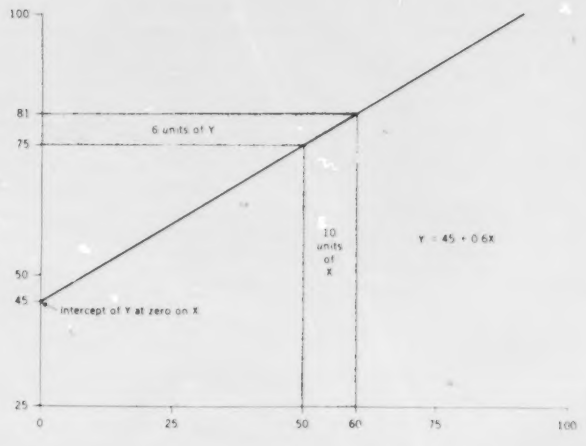

Figure 28. Scattergram and Regression Line for the Graph of the Criminal Area and the Percentage of Housing Units Above the Poverty Line. Source: Based on Hart, 1972: 336. Reprinted by permission of the *Journal of Geography*, National Council for Geographic Education.

Step Four: Mapping Residuals from Regression

The regression formula "predicts" what the value of Y ought to be in a census tract which has a given value of X, if we may assume that X and Y have a perfect relationship to each other, but we know that such is not the case. We can, however, calculate a predicted value of Y (known as Y_p) for each census tract on the basis of that tract's X value, and compare it with the actual or observed value of Y (known as Y_o) for the same tract. The difference between these two values (the "residual from regression") tells us how valid our general relationship is when it comes to predicting the value of Y for that particular tract.

For example, eighty-five percent of the housing units in tract GV-016 are owner-occupied (Column B, Appendix). When we multiply this value of X by 0.6 and add forty-five, our formula predicts that ninety-six percent of the housing units in the tract should be sound. But if we turn to tract 045, at the edge of the CBD, where only two percent of the housing units are owner-occupied, multiply this value of X by 0.6 and add forty-five, we predict that forty-six percent of the housing units should be sound, whereas only four percent were actually so classified.

The Map of Residuals

In similar fashion, the regression equation can be used to calculate predicted values of houses with criminal records for each census tract. Subtracting the predicted value (Y_p) from the observed value (Y_o) enables us to calculate a residual value for each census tract, and these residual values can be mapped to provide an indication of the geographical validity of our relationship (Figure 29).

The examination of the map of residuals from regression tells us where the relationships postulated in our working hypotheses seem to hold true, and where they break down (since the regression formula is the mathematical statement of a theory about the general relationship between percentage of families above the poverty line and the percentage of families with at least one member with a criminal record). A similar procedure and subsequent regression formula might be developed to test our second hypothesis. In any case, if the working hypotheses seemed to hold true, one might argue that the theory appears to hold some validity. If the validity of the theory, i.e., working hypothesis or hypotheses, appeared too faulty, one might decide to reject the current hypothesis and posit a better one, or to abandon the current theory altogether and search for a more meaningful one.

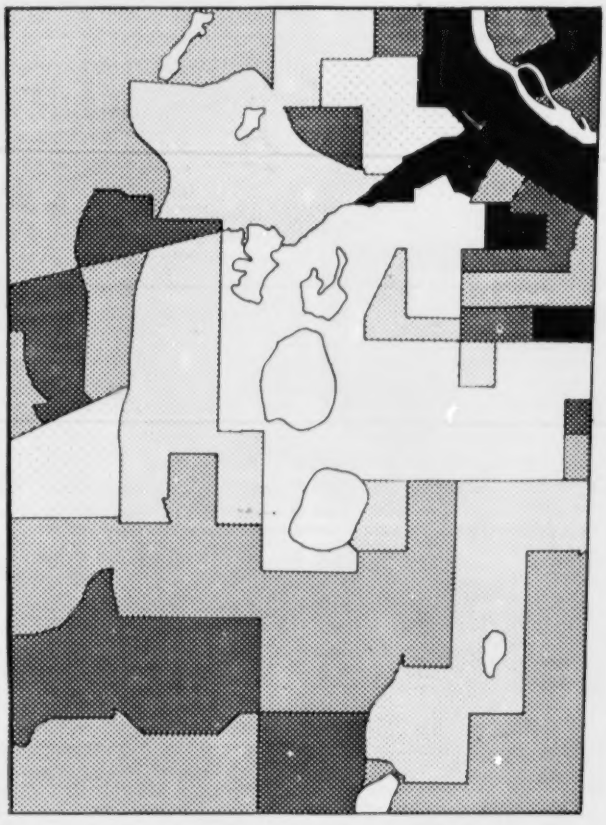

Figure 29. Map of Residuals for Predicted Value of the Houses with a Criminal Record. Source: Based on Hart, 1972: 337. Reprinted by permission of the *Journal of Geography*, National Council for Geographic Education.

APPENDIX

SELECTED 1960 HOUSING UNIT DATA FOR CENSUS TRACTS INCLUDED ON THE MINNEAPOLIS SOUTH QUADRANGLE*

A. Percentage of housing units with occupants with a delinquent/criminal record.
B. Percentage of housing units above the poverty line.
C. Percentage of housing units built since 1950.

Tract	A	B	C	Tract	A	B	C
GV–016	96	85	73	053	46	0	1
GV–017	98	90	71	054	42	3	0
GV–018	98	80	53	055	80	28	2
GV–019	98	89	73	056	68	5	11
SL–020	100	96	57	057	58	2	1
SL–021	99	93	78	058	35	4	1
SL–024	98	95	47	059	39	7	1
SL–025	99	94	60	060	52	19	2
SL–026	96	91	18	061	65	28	1
SL–027	100	89	29	065	97	65	17
SL–028	97	77	42	066	84	35	1
SL–029	99	78	32	067	63	19	5
SL–030	96	56	47	068	80	16	8
H–031	99	92	17	069	44	11	12
ED–035	98	89	72	070	80	26	2
ED–036	100	93	17	071	55	19	4
ED–037	97	91	85	072	68	36	0
ED–038	98	94	72	077	67	24	4
ED–039	99	88	82	078	49	20	3
ED–040	99	86	95	079	61	47	0
RI–041	94	88	67	080	96	26	9
RI–042	97	94	47	081	89	29	4
RI–044	99	76	46	082	87	29	3
RI–045	99	92	59	083	62	21	0
RI–047	99	91	69	084	79	40	1
RI–049	98	91	74	085	85	39	4
				091	93	49	23
Minneapolis				092	97	32	13
				093	96	44	7
023	26	33	1	094	85	44	2
027	92	71	4	095	92	57	3
028	85	60	1	096	98	69	5
029	53	31	1	097	75	64	5
030	60	32	1	098	96	74	25
031	45	34	2	099	94	66	5
032	93	75	20	100	92	59	7
033	75	33	2	101	92	78	12
034	72	13	16	106	98	74	11
035	35	21	0	107	98	77	5
036	30	18	0	108	92	76	5
037	48	18	11	109	98	79	10
041	64	44	6	110	98	84	17
042	93	7	81	112	99	90	15
043	29	4	0	113	99	89	22
044	34	4	1	114	97	90	11
045	4	2	9	115	99	87	11
046A	13	0	0	116	99	79	6
046B	34	5	0	117A	99	88	8
047	8	11	0	117B	99	93	34
051	98	81	12	120A	99	93	67
052	59	2	1	120B	98	75	43

*Source: Based on Hart, 1972: 339. Reprinted by permission of the *Journal of Geography*, National Council for Geographic Education.

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